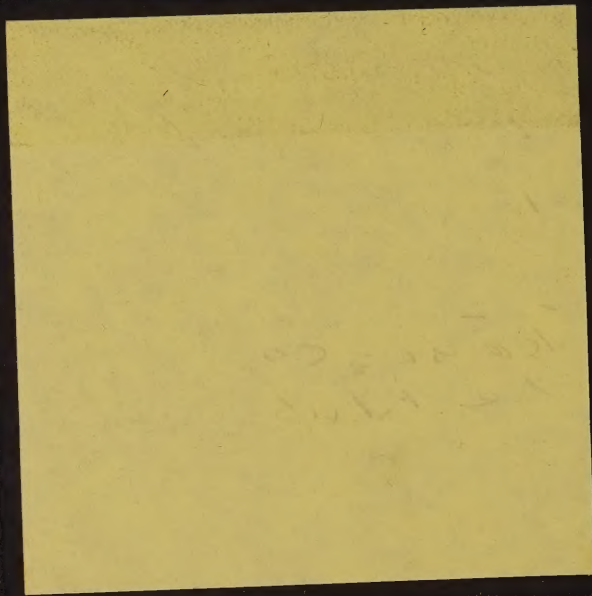


Break in  
delay mod:

100  $\Omega$   $\frac{1}{2}$  watt  
resistors in  
series with both  
leads of C92. (also  
see KRΦU mod)



# The HOT WATER HANDBOOK

....being a collection of articles on the  
modification of the Heath HW8  
QRP CW transceiver....



Compiled and Edited by Michael Bryce, WB8VGE

Second Edition 1986



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## AN INTRODUCTION

Welcome to the second edition of The Hot Water Handbook. This is a collection of modifications and improvements for the Heath HW-8 QRP CW transceiver. Every effort has been made to provide a wide sampling of HW-8 articles, but not everything published about it is here. Some has been omitted deliberately, and there likely is more material out there, unknown or overlooked. With luck, it will be included in subsequent editions.

Since the HW-8 was introduced in the late 1970's, numerous articles -- some lengthy and some only a few sentences -- have appeared about the rig. Many spawned still other modifications. The result has been a plus for Amateur Radio in general and for low-power enthusiasts in particular. It has all been in the best traditions of our hobby.

Much of the credit for the interest and enthusiasm for the HW-8 goes to Adrian Weiss, WORSP, the QRP editor at CQ magazine. His famous series of articles on turning the HW-8 into a "super contest machine" started many of us as fans of the rig and is still very much in demand. It remains a must reading if one is to modify the HW-8 to the fullest and reap maximum benefits from it. Even more important is the fact many of the mods in this collection are based on Ade's work and, to an extent, presuppose modifications he urges have been made. No attempt is made here to reprint his major conversion articles. Bound copies of that series may be obtained from Ade for \$7, postpaid. (See addresses at the end of the book.)

Publication of this is due in large part to the generosity of the authors of the HW-8 modifications offered here. They allowed us to reprint their works, which appeared in the pages of QST, CQ, 73, Ham Radio, Worldradio, SPRAT (published by the G-QRP Club) and The QRP Quarterly, published by the QRP Amateur Radio Club International.

Some modifications appear here for the first time, and for that we are especially grateful to the authors.

A "thank you" to all.

A word of caution: Not all these modifications have been tried by the editors. The fact they appeared in print elsewhere says they work, but there is no guarantee, written or implied, about them. Second, there is some duplication in the kinds of circuits (RIT, improved keying, audio amplifiers, ect.) offered. Look them over carefully and pick the one which will suit your needs best. And installation of one mod might preclude use of another, so check the circuits and their possible effects carefully before proceeding.

This is the second edition of the Hot Water Handbook. Fred Bonavita, W5QJM, took on the task of assembling the first edition. I have updated, changed, and included new mods for the lovers of the HW-8. I do hope you find good reading in the Hot Water Handbook.

It is hoped this collection of HW-8 mods will inspire others and that the results will be shared with the Amateur Radio community.

*Michael Byrne*  
WB8VGE



## ~~X~~ VFO ALIGNMENT IMPROVEMENT

On my HW-8 and several that I have worked on, I discovered that when the VFO is properly aligned, the small trimmer capacitor at the top of the VFO tuning capacitor ends up in a loose condition.

I removed the trimmer capacitor screw and the mica. I then mount a solder lug, using the screw reinserted in the hole. Next I solder the rotator of a small ceramic trimmer (VHF type, about 3-15 pf) to the lug and use the brass strap from the old capacitor, which is still connected to the stator of the main VFO capacitor, to solder to the stator of the new, small rotary ceramic trimmer.

This arrangement is mechanically very much more stable. A piston trimmer can also be used. One QRP'er just inserted a thicker piece of mica so the screw ended up tighter. With either of these modifications, the rig is very stable and can be transported without needing realignment.

Jerry Totten, K8JRO

## IMPROVED 40 METER RECEIVER

I found in comparing signals with other receivers that my HW-8 seemed to leave a lot to be desired on 40 meters, although it was very sensitive on the other bands. A ham friend in a nearby city said he had encountered the same problem in his HW-7. It turned out to be the rf amplifier coil was too high in frequency.

I removed leads 3 and 4 of coil L2 from their solder points and using a grid dip meter found I had the same problem. Not wanting to fool with L2 itself, I pursued capacitor C4, obviously aiming at increasing its value to reduce the over-all resonance of the tuned circuit. The value of C4 was 68pf. I ended up needing about 250pf. I ended up using a frequency counter for fine measurement and got the circuit right on resonance. What a difference now!

Tinkering with a Lighting Calculator, I find now that L2 must be about 2 micro-henries instead of 4.7 like it calls for, and that it would have been resonant at about 13 MHz. Yes, I did check the color dots on the coils, but I'm thinking the factory screwed up and I got another 1.8 micro-henry coil instead of the 4.7, L2.

Dale Kretzer, K6PJV

## RIGGED FOR SILENT KEYING

Here is a modification which replaces the noisy antenna changeover relay with a silent, efficient and economical electronic transmit - receive switching device.

The circuit is a diode switch. During reception, diodes D1 and D2 are forward biased, and D3 is reversed biased, blocking the transmitted sinewave. D3, added insurance, becomes forward biased to pass to ground any rf that might try to sneak through. D4 and D5 are back-to-back, the third insurance factor should the other safety devices fail to protect the receiver.

Transistor Q1 is a switch to ensure the proper bias voltage swing on the diodes. During reception, about 2 volts are applied to the anodes of D1 and D2 and the cathode of D3. During transmit, the anodes of D1 and D2 are at ground, while their cathodes are at 12 volts. This ensures complete reverse bias while D3 is hard on during keying.

The circuit is not difficult to build, even for the inexperienced. I used Vector board and push-in terminals plus components from Radio Shack and Circuit Specialists. The rf chokes are "Micro Mite" molded coils. I used the Miller 9310-40. This is a 15-uH choke with a Q of 65 at 2.5 MHz. You also can make your own chokes out of ferrite beads, but make sure the Q is sufficiently high so that output absorption does not occur.

Installation requires the drilling of a single hole in the HW-8. I mounted the t/r switch in the same manner as the audio amplifier circuit board, using a one-inch metal stand-off. Refer to the HW-8 manual for directions on removing the top and bottom chassis plates, which exposes the printed-circuit and component sides of the board.

I recommend you buy a roll of de-soldering braid. This makes work a lot easier when it comes time to remove the antenna relay and change other components.

Remove RY1. Then on the foil side of the board, install a 1/4 watt, 270-ohm resistor from Point J to ground. This makes the collector of Q13 "see" a load that once was the relay coil.

Mount the t/r switch in the selected spot, as discussed above.

It's time to refer to the HW-8 manual, Page 79, the x-ray view of the main circuit board, and the schematic for the following.

Locate the now-unoccupied solder land that was once the normally closed contact of RY1 to the receive side of the t/r switch (D4, D5 back-to-back diodes). Take the antenna wire from J302 and twist another wire around it. Pass them through the solder land hole that once was the normally open contact of RY1. (Hint: trace "L" to that point.)

Solder the other end of that twisted wire to the transmit side of the t/r switch. Connect the 12 volt line from the t/r switch to the "on" side of SW301, the on-off switch. C305 (.47 uF cap.) is mounted there.

To install the keying line, solder a wire from point "J" to the keying line of the t/r switch (the anode side of D6). One more thing to remember: You MUST ground the t/r circuit either through the metal stand-off or by attaching a wire to the ground foil of the transceiver. This completes the t/r switch installation. Check your wiring again, and get ready to try it out.

Connect power, key. Turn on the transceiver and listen to all those signals barreling in! Connect a clip lead from the antenna jack to the receive terminal of the t/r switch. By shorting and unshorting the t/r switch, you should not hear any degradation of the incoming signals.

Enjoy the HW-8 for a while. Enjoy the silence of relayless keying. until it becomes apparent that the audio recovery is too slow. Not quite QSK! Fast audio recovery is the second phase of this project. To accomplish this, we must look at the break-in delay and mute circuits to understand and correct the problem.

On page 76 of the HW-8 manual, a discussion of the break-in circuit is given. Because there is no more relay, we can decrease the delay that originally was built into the circuit to accomodate the relay.

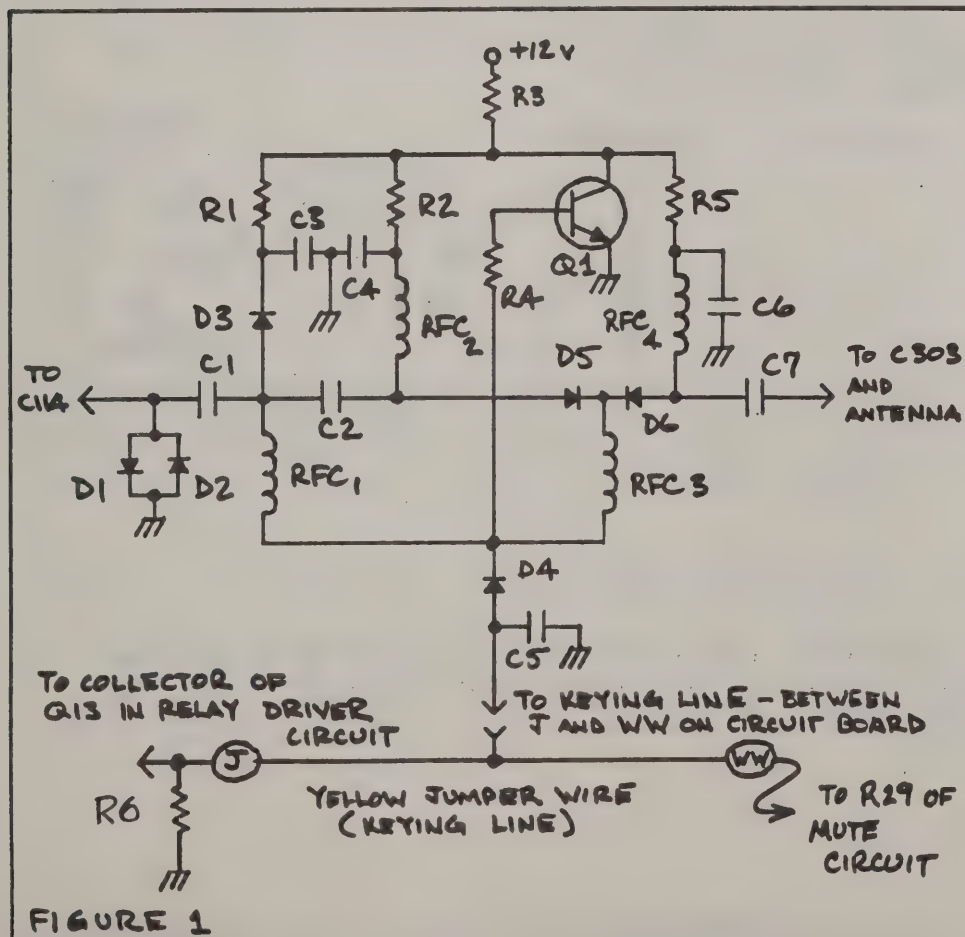
I changed the value of C92 (10 mF cap.) to 1 mF. To soften the keying, I placed a 0.47 mF disc capacitor from the base to the collector of Q11, the keying transistor. (This hint originally was published in SPRAT, and it appears elsewhere in this anthology.-- Editor) Place the 0.47 mF capacitor on the foil side of the PC board.

The audio-recovery rate is determined by the RC time constant associated with IC2C, the audio amplifier, and C38, C39 and R27. With these values, the recovery rate is 2.7 seconds.

Because R27 is frequency independent, I elected to reduce its value to 500K ohms instead of reducing C38, as suggested in SPRAT. With this change, the recovery rate will be about 1.1 seconds.

With these component changes, you will notice some popping. This is a race condition between the receiver recovery and the sidetone oscillator. Adjusting the relay control, R68, probably will eliminate this. If it remains objectionable, you can increase the value of C92 to 4.7 mF or play with the value of R27.

This t/r switch has been in operation for more than six months without any ill effects. The radio is a real joy to operate now, without that unmentionable annoyance.



### PARTS LIST

C1-7 .01 mF  
disc ceramic  
D 1-6 1N914  
or 1N4446  
R1,2,5 1K  $\frac{1}{4}$ W  
R3 330 ohm  $\frac{1}{4}$ W  
R4 3.3K  $\frac{1}{4}$ W  
R6 270 ohm  $\frac{1}{4}$ W  
RFC 1-4 see  
text  
Q1 2N222 or  
2N3904

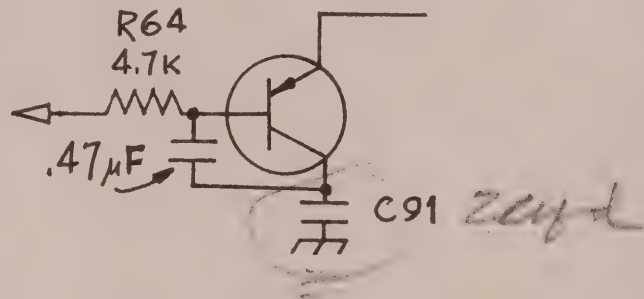
By John McNeil,  
WA2KSM  
From QRP ARCI  
Quarterly

## KEYING WAVEFORM

The leading edge of the HW-8 keyed rf waveform is very sharp and may be considered by some to be unacceptable. The transmitter is keyed by switching electronically the voltage supply to the buffer amplifier which drives the final power amplifier.

The 2  $\mu\text{F}$  capacitor discharges slowly when the transistor Q11 is turned off, giving a slow trailing edge. But on turn-on, Q11 rapidly sucks the charge out of this capacitor to give a fast leading edge.

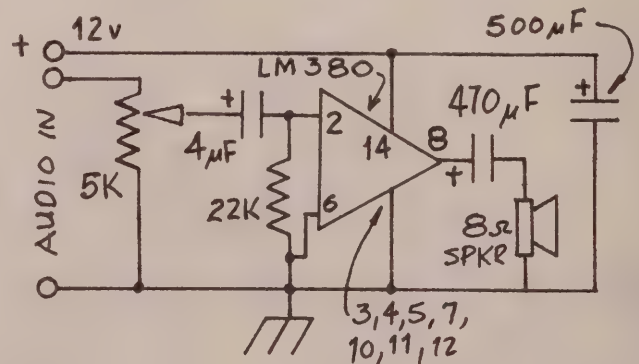
The remedy is to connect an additional .47  $\mu\text{F}$  capacitor across the collector-base junction of Q11, thus slowing the raise and decay of the collector voltage due to the Miller effect. The capacitor is easily back-mounted on the foil side of the printed-circuit board. Mike Perry, PA3ASC/G4HWZ (from SPRAT)



## AUDIO AMPLIFIER

This audio amplifier for the HW-8 or HW-7 works very well and requires no holes to be cut in the rig. It is built into a speaker box with three leads to the rig using spare pins on the power socket on the back panel.

Tom Sorbie, GM3MXN  
(from SPRAT)

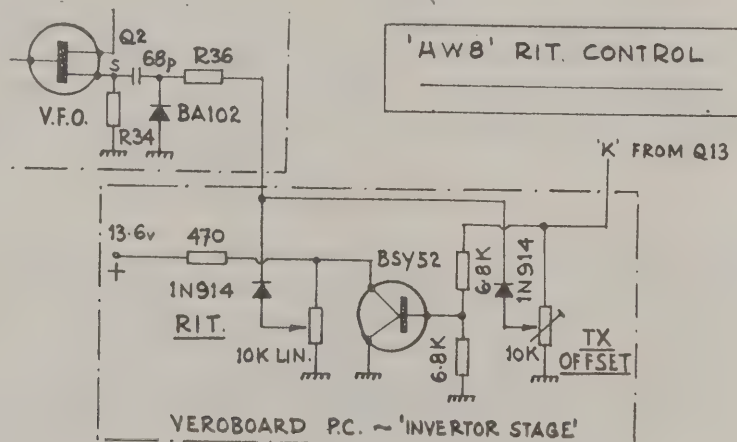


## BOOTS FOR THE HW-8

Looking for an amplifier for your HW-8? Try the ones listed in QST for July 1981, February 1981 (see also Hints & kinks for June 1981), July 1979 and April 1979.

## AN R.I.T. CONTROL

- 1) Replace the switching diode and small capacitor in the VFO with a new 68 pf capacitor and a BA102 varicap diode.
  - 2) Break the lead "K" from Q13 to Q2 and insert polarity inverter stage with BSY52 transistor as shown.
  - 3) Try to place RIT control pot beneath the power meter on the front panel. Use Phillips mini-pot on a bracket with screws.
  - 4) Mount inverter stage on perf board inside left cabinet.
  - 5) Set RIT control halfway and adjust VFO frequency. Check the zero beat of Rx and Tx frequencies on a loosely coupled receiver.
  - 6) In operation, select the high side (USB) of RIT and tune the main dial from high to low, listening to the down-going beat signal, or vice versa.
  - 7) Select the 750 Hz beat note, corresponding to the built-in audio filter.
  - 8) If the signal has QRM, try to use the other side of the RIT, but do not change the main dial.
  - 9) Following this procedure, your signal will be within the audio passband of the wanted station.
- Peter Schaufelberger, HB9IK  
(from SPRAT)



## CURE FOR CHIPRING WITH RIT MODIFICATION

I've installed RIT in my HW-8 using the mod by HB9IK. It works just great and is so simple. However, after the modification, both HW-8's began to chirp. I simply installed a 120K resistor on the foil side from R63 to ground. That solved the problem and now the RIT works super. KH6IJS

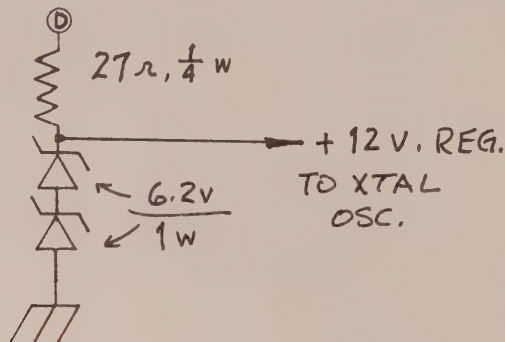
## CRYSTAL OSCILLATOR STABILITY

The dial calibration of my HW-8 varied as much as 5 KHz whenever I switched between power supplies until I made the following change to regulate the supply voltage for the crystal oscillator.

Remove the wire from point "D" on the main board (see drawing). Install one end of a 27-ohm resistor (1/4-watt) at point "D." Connect the removed wire to the other end of the resistor.

Solder two 6.2 volt, 1 watt Zener diode together in series, connection the cathode to pin 8 of SW-4 and anode to pin 4 of SW-4 (the 21 MHz bandswitch).

John Lock, KFOU



## A CRYSTAL CALIBRATOR

One of the shortcomings of the HW-8 is the dial calibration. Its 5-KHz segments are adequate for most operators but might be a little difficult to read for those who must stay in a specific segment of a band.

A simple, inexpensive crystal calibrator, which puts out a signal every 25 KHz, can be found in QST for October 1978 at page 20.

This is an effective unit which can be wired on a small piece of perf board and mounted inside the HW-8 with the on-off switch on the back panel and the output lead loosely coupled to the receiver input near the preselector tuning capacitor.

## TWO MORE ONE-SHOT MODS

1) To stop key clicks and end local interference, connect a 0.22 mfd capacitor between the base and collector of Q11 on the foil side of the board.

2) Replace C38 with a 0.47 pf capacitor to decrease the t/r delay. Leo Delaney, KC5EV

## ANOTHER 30 METER MODIFICATION FOR THE HW-8

After modifying my HW-8 for 30 meters via the Howell Ching, KH6IJS, method, I noticed that on occasion, I could hear HCJB, a shortwave broadcast station in Ecuador. At times HCJB was loud enough to wipe out all but the strongest signals. This happened only at night, and no other shortwave broadcast stations were heard.

Reviewing the schematic and Howell's mods, I found that the RF amplifier was now broadbanded for 30 meters. To make the front end more selective, L1 and L5 need to be modified, and C16 needs to be reinstalled. The hardest part of my modification is the removal and reinstallation of L1. The bracket that holds the tuning capacitor (C302) leaves very little room to accomplish this feat.

The modifications are as follows:

1) L1--remove 25 turns and adjust the remaining 34 turns evenly around the core. No change in the link. Be sure to install the link (4 turns) across the red dot on the coil support.

2) L5--remove 14 turns and adjust the remaining 18 turns evenly around the core.

3) Reinstall C16 trimmer

Tuning is straightforward. Set the preselector to approximately 7 MHz and the frequency to 10.125 MHz. Peak C3 and then C16. Repeak peaking of C3 and C16. The preselector is now peaked on 30 meters. I haven't heard HCJB again.--Ed Popp, K5BOT--QRP Quarterly January 1985

## LOW-IMPEDANCE HEADPHONE USE

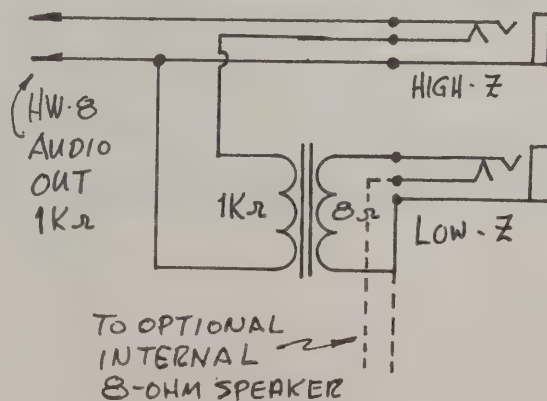
Hers's an easy way to match low-impedance headphones to the high-impedance output of the HW-8. All you need is a small audio transformer (1K to 8 ohms, Radio Shack 273-1380) and two closed-circuit phone jacks. Wire as shown below. The high-Z output will work with high impedance phones or for an outboard active audio filter (MFJ's CWF2, for example), while the low-Z point will work for 4-, 8- or 16-ohm headphones.

John Lock, KFOM

## BATTERY PORTABLE OPERATION

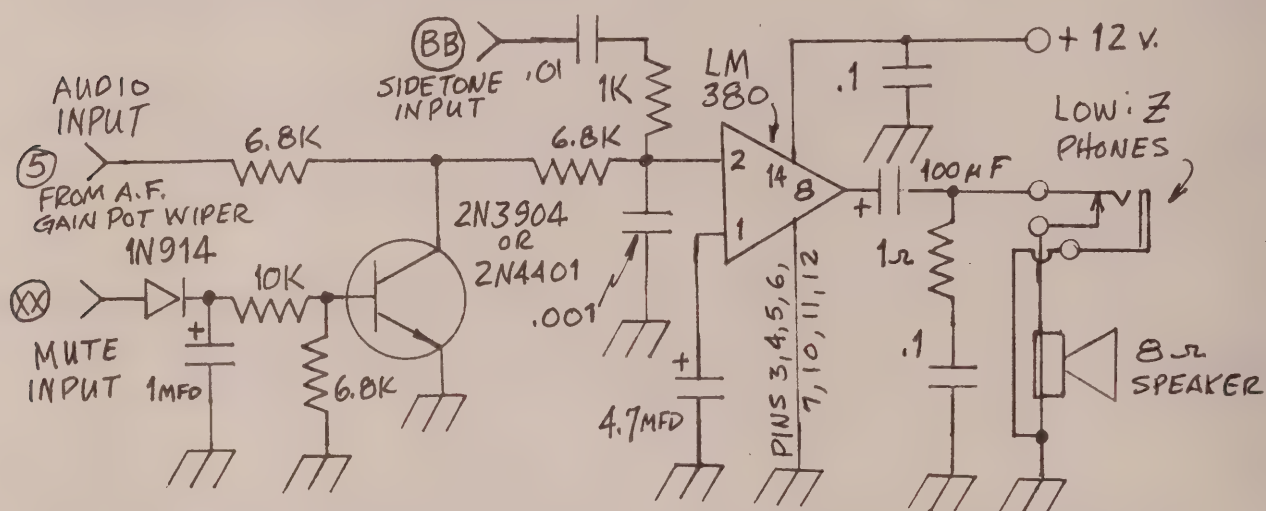
By using NI-CAD battery "sticks" glued to the inside top case, portable operation is possible without carrying a separate supply with you.

Recharge the pack using solar/wind or geothermal energy via the extra pins on the rear power connector.



## INTERNAL ONE WATT AUDIO AMPLIFIER

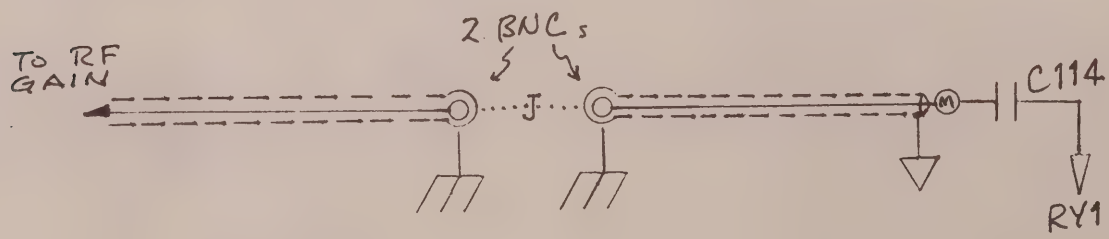
This simple audio amplifier was built up on a small piece of perf board and mounted where the original a.f. amplifier board was located. The original board was removed and discarded to the junk box. This circuits results in the HW-8 being muted in two places in the key-down mode. I also installed a small, 8 ohm speaker on the right chassis wall next to the new amplifier. Cut a hole in the chassis with a chassis punch. Cut a square opening in the outer cover where it fits over this speaker opening, cover it with grill cloth and bolt it in place.----- D.A. "Mike" Michael, W3TS



## PRESELECTOR INPUT

Split the RG-174/U coax from points "M" and "S." Add two BNC connectors to the rear panel. This provides direct access to the receiver input. Jumper across the BNCs for normal operation. This point provides for insertion of preselector, series traps (band stop filters), attenuators, ect. Although the HW-8 is not as bad as the HW-7, out of band or adjacent BIG signals can cause problems.

--Rich Arland, G5CSU



## SMOOTHER TUNING FOR THE HW-8

This is my favorite modification for the HW-8: Adding a second Jackson Brothers 6:1 vernier drive to the front panel. This reduces frequency change per knob revolution from the original 90 kHz to a mere 15 kHz. After operating with this modification, I could never go back to the old 15 kHz-at-a-twitch routine.

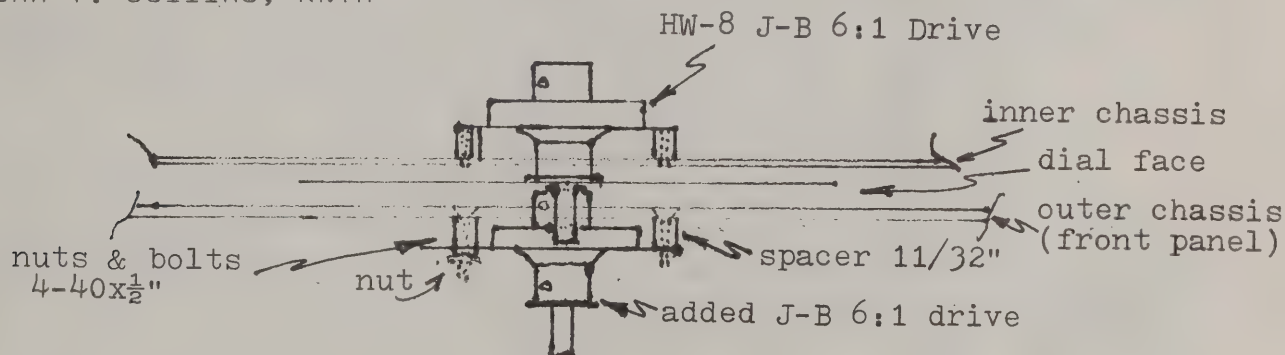
The only drawback is that the new drive is somewhat unsightly on the front panel. I overcame that problem with a 2-inch-in-diameter knob from the junk box. The larger knob also helps the HW-8 feel more like a real radio.

The extra drive was purchased from Heathkit for \$7 bucks a few years ago. (editor's note: The drives can be purchased from RadioKit and other suppliers of parts.)

First, trim all but 5/16th of an inch from the original shaft so the new one can fit as close as possible to the panel. Using the new drive as a template, mark, drill and countersink (from the back) two holes in the front panel for mounting the new drive. Mount the new drive using 4-40 x 1/2 inch flathead bolts and nuts and the 11/32 inch spacers. If all is right, the new drive will slide right onto the shaft of the original one when the front panel is reinstalled.

Tighten the set screws, install the knob and you're ready to enjoy extra-slow tuning rates. The only major problem is this mod is possibly mis-aligning the two drives. I suggest marking the front panel for drilling while it is still fastened to the HW-8. That way, the two drives will be coupled when the drilling marks are made.

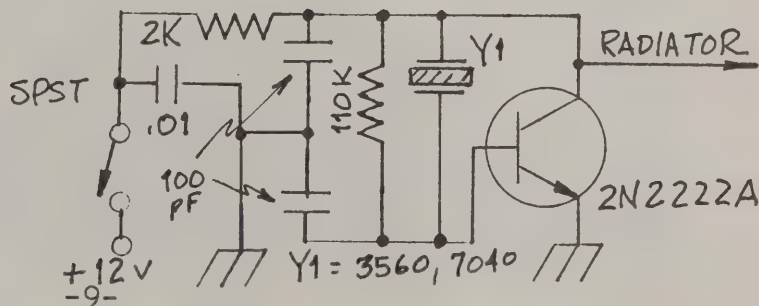
John T. Collins, KN1H



## THE HW-8 NETTER

Hers's a handy, simple inexpensive calibrator to help you make sure of getting on the net frequency. The radiator is a piece of wire taped on the rear wall inside.

Jim Fitton, W1FMR



## 30 METERS FOR THE HW-8

When considering the addition of the 30 meter band to my HW-8, I knew one thing for sure: I did not want to give up either 40 or 20 meters to acquire performance on 10.1 Mhz. Since 80 meters is a rarely used band out here in Hawaii, I determined to sacrifice it rather than any of the others.

With the help of Zach Lau, KH6CP, I got to work on a conversion of the HW-8 to 30 meters using available components plus a crystal and a handful of replacement capacitors. I've converted two HW-8s this way. The first one took the better part of a day. The second was completed in less than three hours.

This conversion is straightforward, and I encountered no problems. I should caution, however, that spacing of the windings on the toroids affects inductance, so keep turns as uniform as possible. I used a grid dip meter to check the rewind coils resonant frequencies and then dipped them in hot candle wax to hold the turns in place.

OK, here are the simple steps, starting with the receiver:

- 1) Remove C1, C15 and C16 (trimmer) and snip off R50.
- 2) Disconnect C301A from the circuit.
- 3) Replace Y1 crystal with an 8.895 MHz rock in an HC-6/U holder with 30 pf loading and a .005% tolerance.

- 4) Replace C116 with a 43-47 pf capacitor (I used 47pf) and replace C64 with a 27-33 pf capacitor (I used 33 pf).

Transmitter section (Note: use silver mica capacitors):

- 1) Remove C94.
- 2) Replace C77 with a 150 pf capacitor; C78 with 150 pf; C96 with 85 pf; and C97 with 270-300 pf capacitor ( I used 270 pf).

- 3) Remove, alter and replace the original coils as follows:

L22 (9 uh, 25 turns originally) unwind 10 turns and adjust the remaining 15 turns evenly around the core.

L26 (15.5 uh, 36 turns originally) unwind 19 turns, but do not respace the remaining 12 turns.

L27 (27.5 uh, 36 turns, originally) unwind 23 turns and adjust the remaining 13 turns around the core evenly.

In all cases, the changed coils should have an inductance of 3 uh. When unwinding the toroids, do not trim excess lead length until the coil has been resoldered to the proper spot on the pc board. The long leads make them easier to thread back into place.

Realignment:

Adjust L17 until the new crystal oscillates properly. Check alignment of L18 (40 meters), since there is some interaction between these coils.

L13 in the mixer section will have a broad peak. I got the best rejection of unwanted signals with the slug turned counter-clockwise until it was nearly level with the top of the stack.

Initially, I found the frequencies generated by the HW-8's VFO (8.645 to 8.985 Mhz.) could be heard quite loudly in the new 30 meter band. I used my grid dip meter to generate a signal in that range and then adjusted L13 for the best rejection of these frequencies.

Howell Ching, KH6IJS, QRP Quarterly, April 1984

X

DOES HW-8 - 20M +\$10 = 30M? YOU BET

How about a conversion for your HW-8 that will get it on 30 meters for \$10 (more or less) and only at the sacrifice of 20 meters? Such a deal!

This is a very simple modification that requires only a new crystal, a handful of capacitors and less than one hour's time to get your HW-8 on the new 30 meter band where its two watt output is more than adequate to work your heart out. You have to be willing to sacrifice the 20 meter band to make this mod, however.

The first thing you need is an 18.895 MHz crystal (.005% tolerance, HC6/U holder, 30 pf loading). You will also need some small capacitors, whose values will be given in a moment. Since they are in rf circuits, use silver micas, polystyrenes or NPO ceramics.

My reasons for dumping 20 meters in favor of 30 meters are two fold: First, the heterodyne oscillator and other circuits which have to be re-peaked can be changed easiest by simply adding capacitance in parallel on the foil side of the PC board; and, second, the final amplifier low pass filter as designed by Heath for 20 meters falls within the range for harmonic reduction for 10 MHz.

So here's how to modify the HW-8 for 10 MHz (check off the steps as you go): ( ) Wire a 47 pf capacitor in parallel with C121 on the foil side of the board. ( ) Replace crystal Y3 with your new 18.895 MHz rock. ( ) Peak L19 as instructed in the HW-8 manual. ( ) Add a 100 pf capacitor in parallel with C68 in the mixer amplifier. ( ) Peak L15. ( ) In the rf amplifier, parallel C22 with a 37 pf capacitor ( ) and C7 with a 68 pf capacitor. ( ) When you adjust C7, a definite signal peak will be heard. However, if this occurs with C7 fully meshed, more capacitance will have to be added until you have a nice tuning adjustment. With C22 adjusted for maximum signal, the preselector variable capacitor will peak about half-way out. If not, add a little more capacitance until C22 has a good peak and adjustment range. ( ) C104 in the final amplifier must be paralleled with an additional 10 pf. Adjust C103 for maximum output. This concludes the changes for the HW-8. My special thanks to W20QI, WB2YDS and W2JFP for their help in this.---Southwest QRPer, March-April 1983

X

CHEAP AND DIRTY QSK

While you have your HW-8 on the bench, there's another modification worth trying. Replace the noisy relay that comes with the rig with an SPDT 12-volt mercury-wetted relay. This makes for silent keying and a very fast break-in (near QSK) can be had by adjusting the t/r delay pot to its minimum position. Howell Ching, KH6IJS, QRP Quarterly April 1984

## FOUR WATTS FOR THE HW-8

One may ask, "Why more power from a QRP rig?" The reasons for my search for more power were twofold: first is the declining sunspots and the worsening conditions, and second is that much QRPing is done mobile from my fishing campsite on the beach using a Hustler mobile antenna mounted on the right rear of my Toyota Landcruiser. Every milliwatt of power helps in this kind of set-up.

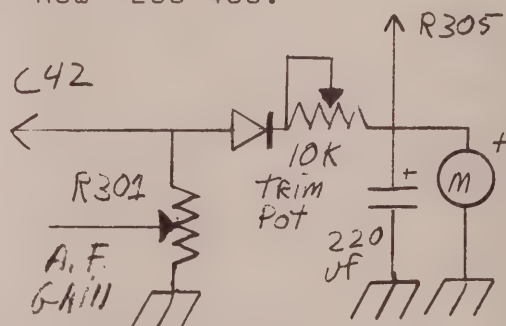
After checking the specifications of numerous transistors, I found that the Sylvania ECG 488 showed great promise. I simply replaced Q9 (2N4427) with the ECG 488 and retuned L13 through L16 and L95, 99, 103 and 106.

Now I get as much as 2 watts output on 15 meters and between 3.0 and 3.7 watts out on 20, 30 and 40 meters using a 12.5 volt power source. In excess of 4 watts was obtained on some bands using 13.5 volts. All power measurements were made using a dummy load and a Bird wattmeter

I had already modified my HW-8 as per WB7OVJ's article. This mod might not be needed to handle the higher power. My version is shown.

--Howell Ching, KH6IJS--QRP Quarterly, October 1984

Editors note: Try using the transistor from the final amplifier of an old "CB" radio. Many times an old CB can be purchased for less than the cost of the "new" ECG 488.



## SIMPLE REMEDY FOR DRIFTING HW-7

My HW-7 would drift so rapidly that I had great difficulty maintaining contact once a QSO was initiated. I tried every remedy I could think of with no results. Then I found a solution in "Solid State Design" by DeMaw and Hayward. Nearly all of the FET VFO circuits in the book included a diode across the gate bias resistor but the HW-7 lacks it. I soldered a 1N914 diode on the foil side of the printed circuit board across the 47K resistor R21. See schematic. Now the rig is nearly as stable as my old Tempo One: drift is detectable over long periods of time but is slow enough to be tolerable. Jerry Bartachek, WDOCA

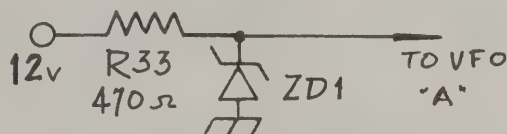
## CURING ZENER DIODE NOISE

One of the chief sources of internal noise in the HW-8 is ZD1, a 9.1-volt Zener diode in the VFO. Remove ZD1 and R33 (470 ohms). Mount a two-point terminal strip on the chassis wall near the audio amplifier; one pin should be a ground lug.

Wire the circuit as shown below. Pick up 12 volts for R33 from nearby pint, such as the on-off switch. Run a wire to point "A" in the VFO circuit.

To test for a possibly noisy ZD1, connect a 50 ohm load to the antenna back; switch to 21 MHz.; open the audio gain all the way; and listen with ZD1 in and out of the circuit.

Leo Delaney, KC5EV

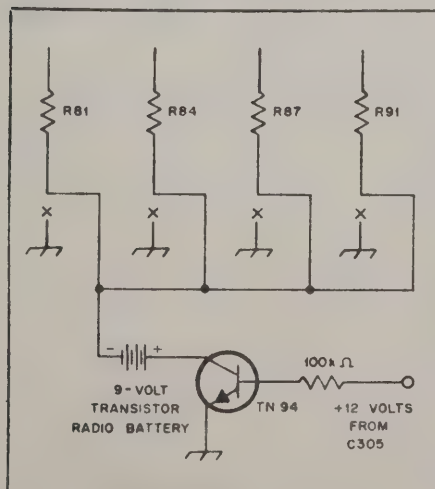


## PARASITIC OSCILLATIONS

Here's a method of eliminating parasitic oscillations in the HW-8. Although Doug DeMaw has implied that the spurious radiation from this source is weak enough to satisfy the FCC rules (April 1979 QST, page 18), I still consider it ethically and esthetically unsatisfactory to operate the transmitter without silencing this unnecessary noise.

The direct current bus lines to the band-switching diodes for the three bands which are not selected support the relaxation oscillations in the audio-frequency range when the key is down and the transmitter is on the air. The amplitude of these oscillations depends upon the position of the receiver preselector and rf gain controls and may become large enough to be heard in the headset, in spite of the muting circuit and the sidetone. They are probably the cause of the spurious radiations referred to above.

I have eliminated these oscillations in my HW-8 by providing back bias to turn off the bandswitch diodes which are supposed to be off. I did it by lifting the grounded ends of resistors R81, 84, 87 and 91 from the circuit board. These are connected to a "C" battery as shown in Fig. 1. A TN94 disconnects the battery when not in use. The drain is about 0.2ma so that I expect long life for this bias supply. My HW-8 is now clean and quiet and otherwise operates exactly as before.--James E. Gray, W0GNV



## SPEAKER GRILL

A good looking speaker grill may be purchased from Ten-Tec. Ask for the part that is used for the Argosy.

## REFLECTED POWER MEASUREMENT

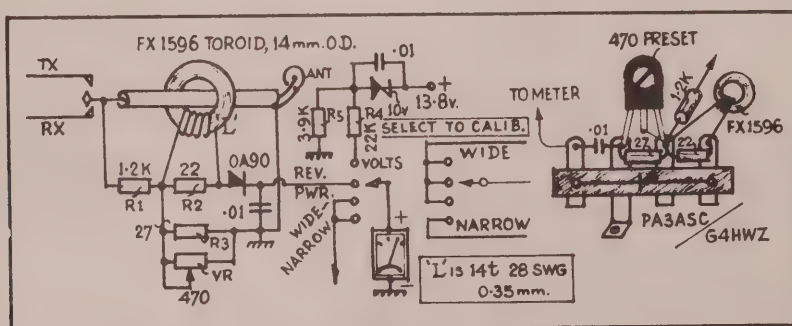
The front panel meter of the HW-8 can be used to measure reflected power using the circuit below, which has been designed for a 50-ohm output. The principle is well known. Antenna current passes through a short piece of coax, which is encircled by a high- $\mu$  ferrite toroid suitable for the frequencies involved. The toroid samples the current, and the secondary winding develops a voltage across R2, which should be about 300 mv for full RF output (a good test to see if the ferrite is stable). The braid acts as an electrostatic shield and must be earthed (grounded) only at one end. Voltage is sampled by R1 and R3 and added to the voltage across R2. The result is rectified and fed to the meter via a switch.

Installation is as follows: Remove the front panel and replace the audio bandwidth switch with a 3-pole, 4-way switch about 22mm in diameter. Replace the front panel and reconnect the "RF output" and "wide/narrow" functions. Remove the lead from the antenna socket to the relay.

Construct the SWR circuit on a tag strip, keeping all leads as short as possible. Drill a 3mm hole in the rear panel near the antenna socket, and mount the tag strip, remembering to make a good ground contact. Connect the lead from the diode to the switch. Wind 14 turns onto the toroid and slip it over the coax. It may be necessary to remove the outer PVC sheath and insulate the toroid with a thin layer of tape. Ground the braid at the antenna socket and connect the relay to the antenna output. Connect the toroid and R1, and set VR to maximum.

A Zener diode and a resistor network may be used to check the supply voltage, useful for portable operation. Calibration is impractical. Components may be mounted on a tag strip secured by one of the bolts holding the meter on place.

--Mike Perry, PA3ASC/G4HWZ---SPRAT, Autumn 1980



# R.I.T.

Here is an effective RIT circuit which uses a minimum of parts and which can be assembled on a small piece of perf board and a small terminal strip.

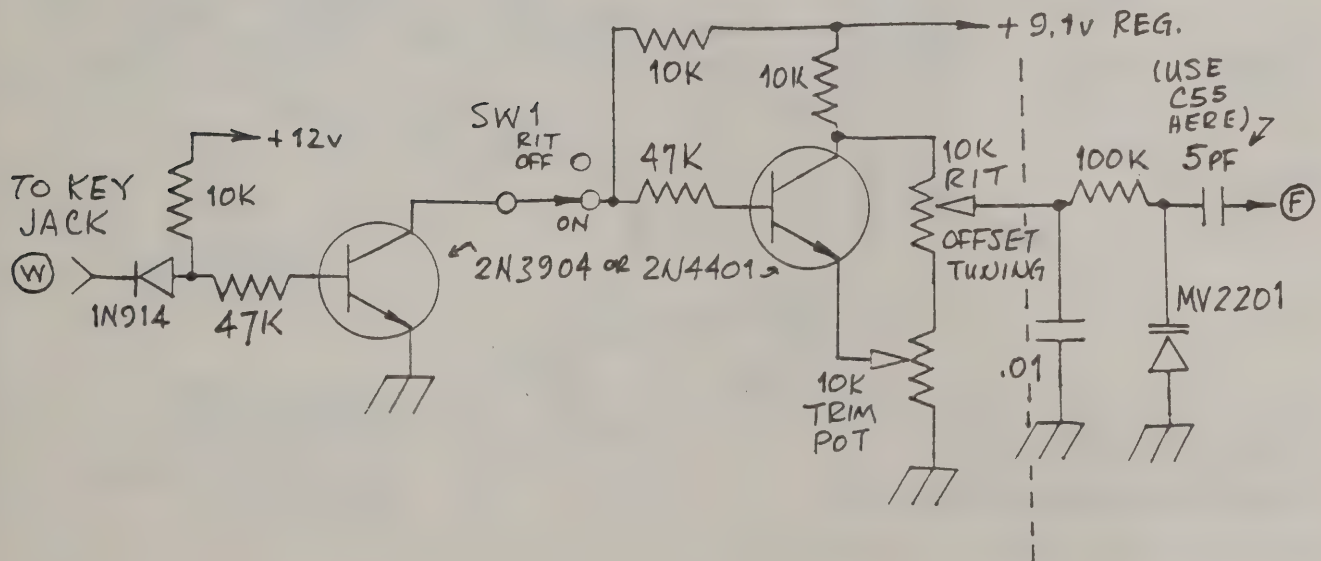
Remove SW302 (wide/narrow filtering). If it is desired to retain this function, an SPDT miniature toggle switch may be installed in the upper right of the front panel near the preselector tuning capacitor. Otherwise, the rig may be wired permanently in the narrow position by disconnecting the three wire cable between SW302 and the main PC board. Jumper between points "HH" and "EE" on the board. Now mount the 10K linear-taper offset tuning pot in the hole left by SW302.

Drill a hole in both front panels to left of the new RIT control for SW1. This switch is either a normally closed pushbutton switch or a normally closed toggle switch with a momentary contact. It disables the RIT for zero beating the incoming signal.

Remove C55 (save it for use later), D11 and R36. Assemble all of the components to the left of the dashed line in the schematic on the perf board and mount it on the inside wall near the zero beat switch, SW1. Use a small stand-off. Mount the remaining components on a small terminal strip and fasten the strip to the frame of the VFO tuning capacitor.

With the RIT offset tuning pot set at midrange, adjust the 10K trim pot to set the desired shift on either the high or low side of zero beat. The pitch should not change with SW1 open or closed.

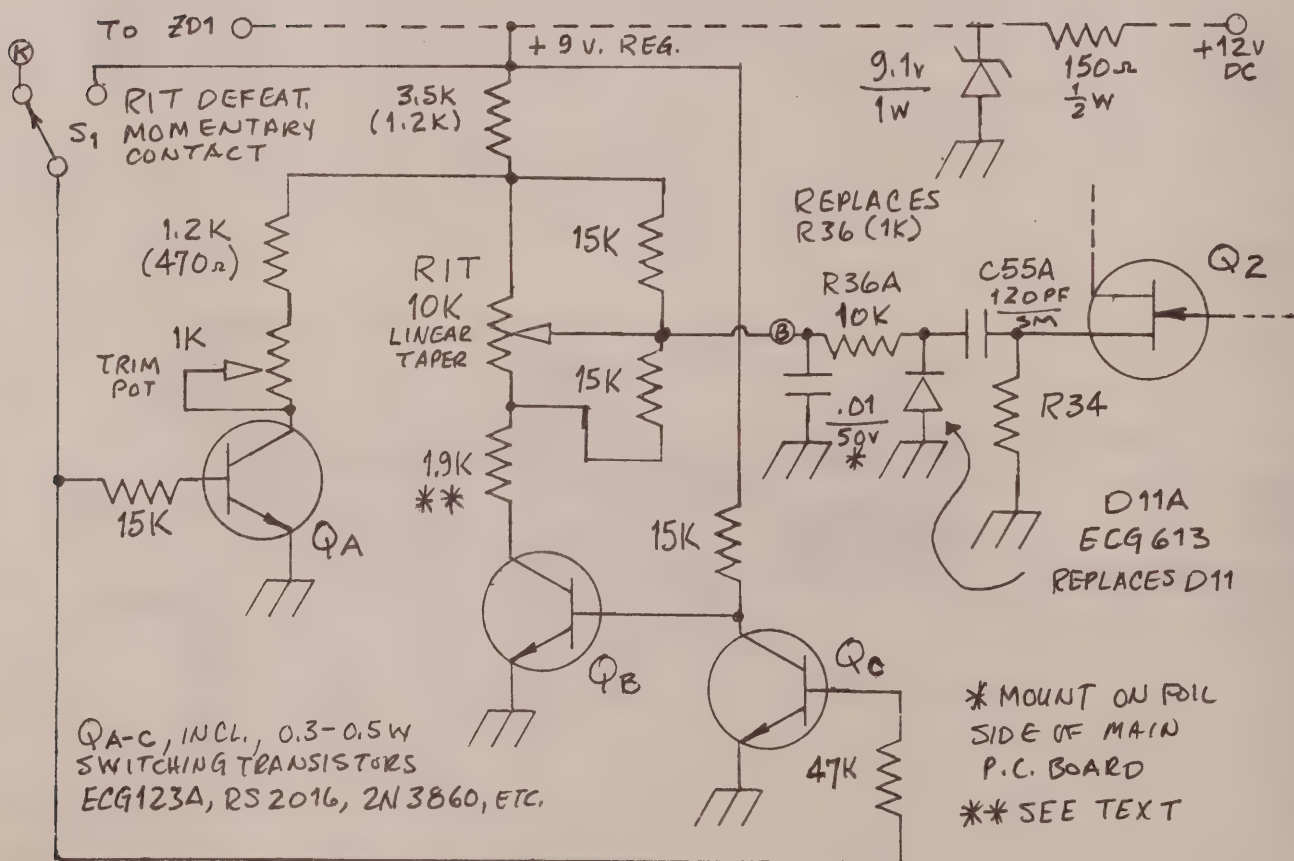
D.A. "Mike" Michael, W3TS



## RECEIVER INCREMENTAL TUNING (RIT)

Here is my version of the K6TG RIT modification (QST, July 1977), which I used more than two years with no problems. It does not require drilling holes or cutting the foil of the main circuit board. The circuit is built on a Radio Shack board (RS-276-024). Values shown in parentheses are the minimum for proper operation and component values may be juggled to tailor the range of the RIT. The 1.9K ohm resistor (\*\*) may be varied or eliminated to adjust the range. The dashed lines at the top show an optional power control circuit

R36A and C55A replace R36 and C55 on the main board. D11A replaces D11, and the .01 mF capacitor (\*) is mounted on the foil side of the board. The RIT control (10K linear taper pot) may be mounted between the load control and the rf-output meter, if a miniature pot can be found. S1 can be mounted at the left of the preselector control in the spot indicated by CQ magazine (October, 1977). Power can be taken from ZD1 or ZD101. --John Lock, KFOM

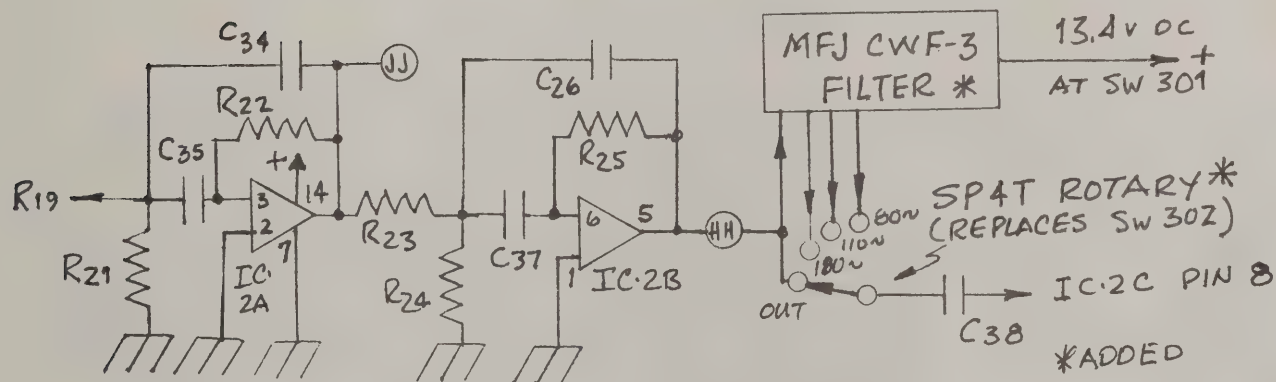


## AN INBOARD ACTIVE AUDIO FILTER

Here is an easy way to add an active audio filter to the HW-8 inside the chassis. You will need a single pole, four throw, non-shorting rotary switch and an MFJ Model CWF-3 audio filter out of its box. Mount the filter on the rear wall of the HW-8 on 1/4 inch standoffs. Remove SW 302 (the wide/narrow switch from the front panel) and replace it with the rotary. Disconnect the three wire cable running from the audio filter on the board to SW302, and scrap it and the switch. The output for the new MFJ filter is picked up at the "narrow" point (HH above). The old "wide" point (JJ above) no longer is used, and the HW-8 stays wired for "narrow" filtering at all times. Connect the rotary switch to the MFJ filter as shown, with the steps reading out, 180, 110 and 80 going clockwise. This provides for great selectivity and does not result in boring any more holes in the box.

Rich Arland, G5CSU/K7YHA

Editor's note: If you have used the SW302 hole for the RIT control as Adrian Weiss recommends in his modification series, the rotary switch for this inboard filter can be mounted on the rear face, with the switch being easily reached across the top of the box. This also will make for shorter leads.



## ANOTHER SWR INDICATOR

Check August 1982 QST (Hints & Kinks) for a compact SWR indicator that ought to fit inside the HW-8 with some judicious squeezing.

XXX

## HW-8 OFFSET PROBLEM SOLVED

Here's a simple solution I found for an HW-8 that offsets more than or less than the 750 Hz on transmit, thereby causing off-frequency net operation or band-walking. (A phenomena that results when two transceiver operating hams keep raising or keep lowering their dial to compensate for poor offsets).

The problem is caused by capacitor C55 (5pf on the schematic), which is switched into the VFO on transmit to lower the frequency so that a 750 Hz beat note is heard on receive. If it's a little off, you have problems.

Remove C55 (next to the VFO variable) and install a ceramic trimmer of the 2-8 pf range in its place. With the rig on and the covers off, short diode D11 to ground (imitating transmit mode) and zero-beat a steady carrier or long winded CW operator. Then remove the short to see how close the received beat note comes to the peak of the active filter bandpass (the loudest note). Adjust the trimmer and keep checking until you get it perfect and you will have solved your case.

Barry L. Ives, AI2T

Editor's note: One can also couple a frequency counter to the VFO. Note the frequency of the VFO on receive. Lock the HW-8 in transmit (into a dummy load of course), and note the frequency of the transmitter. Adjust the trimmer capacitor you installed in place of C55 until there is exactly 750 Hz shift down in frequency.

## CHOPPY CW FIX FOR HW-8

My HW-8 exhibited an excessibely long rf output decay time. This resulted in choppy sounding CW at the higher keying speeds. Above about 25 WPM the output became a steady carrier even though the sidetone sounded good.

The problem was traced to the break-in delay circuit (Fig.1). Capacitor C92 was discharging through Q12 causing keying transistor Q11 to remain in conduction for over 100 milliseconds after the key wa released. The solution was to reconfigure Q12 to function as an ordinary diode. When the key is up, Q12 is reverse biased, effectively disconnecting C92 from the keying circuit.

To make the modification, simply remove resistors R66 and R67 (both 4700 ohms). Then solder a jumper wire between the base and collector of Q12. This modification had no noticeable effect on the break-in delay circuit or the setting of the delay control

Robert Lewis, W3HVK,

Would you like to increase the tuning range of your HW-8? I did and I found it very easy to do. I wanted to listen to some of my friends on 75 and 40 and also be able to receive CHU just above 7300 khz.

To make this modification, only two parts are required: a capacitor to pad the VFO tuning and a toggle switch to add it or leave it out of the circuit. I used a trimmer capacitor, but if you are not too fussy, a fixed capacitor of 12 pf will do.

I located a miniature switch on the rear panel so that no injuries were inflicted on the front panel. One side of my trimmer is grounded, so it was simpler to run the other lead to one side of the toggle and then tie the other terminal of the switch via a piece of tinned bus wire to the lug on the VFO tuning capacitor.

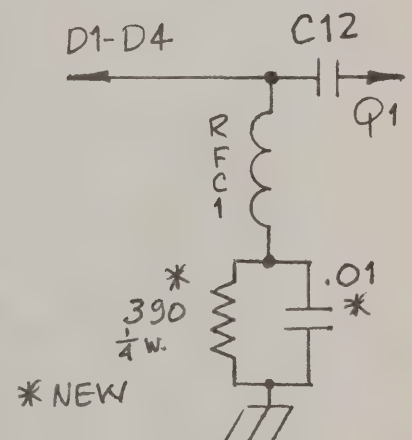
One adjustment and you are in business. With the new capacitor switched out of the circuit, open up (reduce) the mica trimmer (C362A) on the VFO tuning capacitor to offset the stray capacity of the added circuitry. Adjust the VFO to 3500 Khz when the dial reads 0. If in doubt, adjust it so that W1AW broadcasts are on 3580 Khz. No adjustments are required for the other bands. Throw the toggle switch and adjust the new trimmer for 3750 Khz for 0. The dial will now read 250 Khz higher on all bands or tune from about 3750 Khz to 4000 Khz on 80 meters. DO NOT OPERATE THE TRANSMITTER FUNCTION OUTSIDE OF AUTHORIZED BANDS.

Roger Amundsen W1PQ, 73 magazine, October 1981

#### ANTI-MOTORBOATING FOR THE HW-8

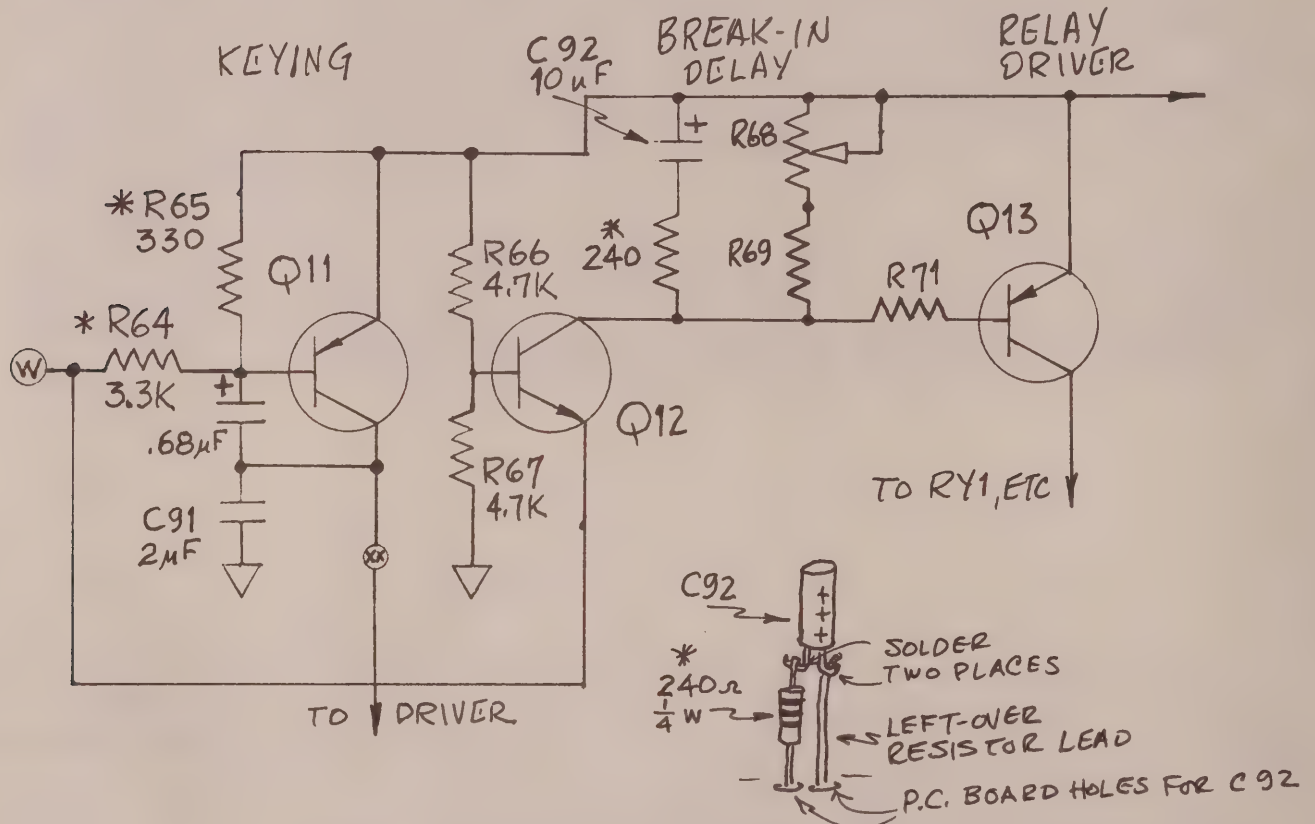
Jim Gray, W0GNV, described a cure for the poor bandswitch isolation that leads to motorboating during transmit. This simpler method accomplishes the same thing but without the bias battery and switching transistor Jim used. The required reverse-bias voltage for D1-D4 is generated by allowing bandswitching current to flow through a 390 ohm resistor. Diodes not selected see 3.6 volts, enough for good isolation. C12 blocks this voltage from Q1.

Tim Groat, KROU, QRP Quarterly, April 1984



# KEYING-SHAPING MOD FOR THE HW-8

This modification eliminates the harsh keying caused by the fast rise-time of the keyed signal. A 68-uF capacitor (tantalum or other compact, low-leakage type) is connected from the base to the collector of Q11. The positive lead should be on the base. It may be mounted on the foil side of the circuit board, under Q11. It's also necessary to change the values of R64 and R65 to obtain proper shaping, since the original values give too slow a decay and virtually unreadable keying. R65 is now 330 ohms, and R64 is 3.3K ohms; the rise and fall times are about 5 milliseconds.



BREAK-IN CIRCUIT MODIFICATION

If you use a key or keyer with delicate contacts (or ICs), you may have experienced contact burning or premature failures. This is caused by high surge currents which flow to charge C92 in the break-in circuit. To limit these surges, install a resistor in series with the capacitor. A 240 ohm resistor limits the current to less than 60 mA. This will be adequate in a majority of cases. The resistor may be installed without cutting the circuit board by connecting it in series with the negative lead of C92. (See drawing above) The other lead of C92 is extended with the lead trimmed from the resistor.

Don't try to simplify this by putting the resistor in the key line. This will only delay operation of RY1, chopping off the beginning of the first dot or dash sent. The method shown does not slow down the relay. Tim Groat, KROU--- QRP Quarterly-- April 1984

# LAUNDRY LIST OF MODS

Rich Arland, G5CSU/K7YHA, and Bob Lusby, G5EBA, offer the following collection of one-shot and easy modifications, which they say have been worked out over the years to make the HW-8 run smoother:

1) Replace the main tuning knob with a larger, heavier knob of metal. Good source: the junk box, hamfests, ect.

2) Replace the preselector tuning knob with one whose diameter is about twice the size of the one Heath provided.

3) Replace the RCA phono connector. BNCs don't have the impedance "bump" which some SO-239s and ALL RCA phone jacks exhibit at RF. SO-239s are easier to provide male plugs for, but BNCs tend to work out better for less loss at RF.

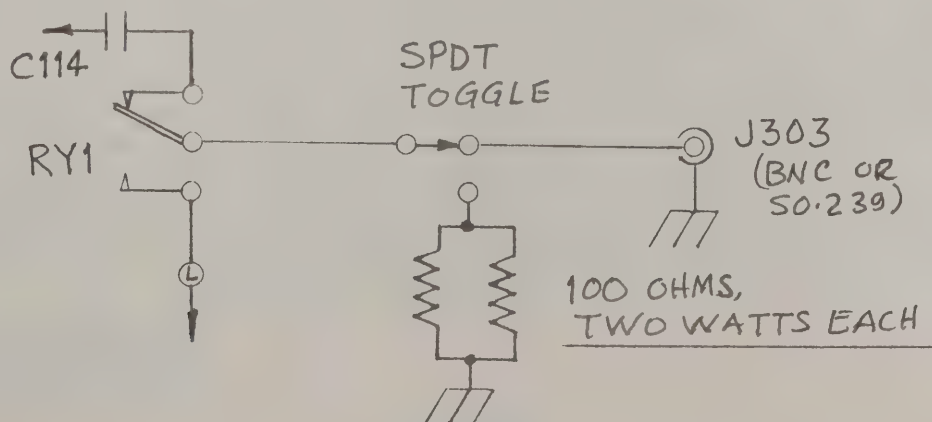
4) Add a husky bolt with a solder lug to the inside of the back panel for a ground post for the rig. Scrape paint away to expose bare metal, and add two nuts on the outside to clamp ground wires.

5) Add a 3.5mm phone jack in parallel with the standard 1/4-inch jack so the "new type" light headphones can be used without adapters.

6) Add a 12v d.c. miniature light bulb in back of the meter. Connect one side of the bulb to the nearest ground with the other side going to point "E" on the main board through a 100-ohm, 1/4 watt resistor to prolong bulb life. The bulb and resistor are in series.

7) Monitor point "C" or point "H" on the circuit board with a high-impedance frequency counter to get digital readout. Be sure to bypass any jacks added to the rear panel for this.

8) For a built-in dummy load, install a toggle switch on the rear panel close to the antenna jack. Remove wire form center pin of antenna jack and solder it to center contact of the SPDT switch. Route one side of the switch to the arm of the antenna-changeover relay (RY1). The other side of the switch is soldered to two 100-ohm, two watt resistors in parallel to ground. A flip of the switch provides a 50-ohm dummy load which is handy for transmitter tuning prior to external tuner adjustment; terminates the receiver in characteristic impedance for sensitivity checks; and cuts down on the number of accessories that must be carried for portable or mobile operation.



## IMPROVED STABILITY AND DIAL CALIBRATION

The HW-8 transceiver exhibits approximately 150 Hz drift in transmit and receive frequency when the supply voltage varies over a range of 10 to 13.5 volts DC. This results in a CW chirp when using a poorly regulated supply, such as weak, dry batteries. Additionally, the VFO dial calibration is in error on all but the 7 MHz band.

Most of the drift and chirp problem is caused by the heterodyne oscillator, Q6. The reverse-biased switching diodes in the tuned circuits of all but the selected band exhibit a capacitance which varies with the supply voltage. This capacitance, essentially in parallel with the selected crystal, causes pulling of the oscillator frequency. The solution is to regulate the supply voltage to Q6. The small amount of shift which still remains after Q6 is stabilized is caused by the inability of the Zener diode (ZD-1) to stabilize fully the voltage for the variable frequency oscillator (VFO), Q2. This can be corrected by replacing the Zener diode regulator circuit with a Motorola MC7808 three-terminal regulator integrated circuit.

The VFO dial calibration problem is a matter of fine tuning the VFO and HFO in accordance with the procedure described here. The Heathkit procedure does not calibrate the frequency of the HFO; it also does not switch the offset capacitor, C55, in during VFO calibration so that the dial will read transmit frequency.

Modification procedure: Remove the following resistors. R78, R81, R82, R84, R85, R87, R88 and R91. Install 7.5-volt, 1-watt (SK-3059) or equivalent Zener diodes (anode lead to ground) in the positions formerly occupied by R81, R84, R87 and R91 (100K resistors). Install 470-ohm, 1/2-watt resistors in the positions formerly occupied by R78, R82, R85 and R88 (1K).

Install a .01 uF, 25 VDC ceramic capacitor on the foil side of the main PC board. Solder one lead to the junction of R36 and the yellow wire which attaches to point "B." Solder the other lead of the capacitor to a nearby ground foil. Remove ZD-1 and R33 (470 ohms). Drill a 1/32-inch hole midway between the two holes from which R33 was removed. Install the MC7808 voltage regulator as follows.

Input "B" lead to R33 hole which ties to 13.4 volt line; insert common "C" lead through the drilled hole and output "E" lead to R33 hole which ties to C52 and R3 (47 ohms). Solder and clip the excess from the "B" and "E" leads. Slip a piece of insulation over the "C" lead and solder the lead to a nearby ground foil. Be sure that it does not short to other foil leads.

Fine alignment procedure: Make a pickup loop (this consists of a length of RG-59 coaxial cable with a 2-turn loop, one end soldered to the center conductor and the other to the braid) and place it around L19-21. Connect the opposite end to the antenna terminals of a calibrated receiver capable of tuning 12 to 30 MHz. (Note: A frequency counter may be used here.) The output of the HFO can be picked off at the emitter of Q7, preferably through a .001 to .01 uF coupling capacitor. The pickup loop likely will not provide enough signal to drive the counter.

Press the 3.5 MHz bandswitch. Tune the calibrated receiver to 12.395. Adjust L17 (bottom slug) for zero beat.

CONTINUED TO PAGE 23

Press the 7 MHz bandswitch. Tune the calibrated receiver to 15.895 MHz. Adjust L18 (top slug) for zero beat.

Press the 14 MHz bandswitch. Tune the calibrated receiver to 22.895. Adjust L19 (bottom slug) for zero beat.

Press the 21 MHz bandswitch. Tune the calibrated receiver to 29.895 MHz. Adjust L21 (top slug) for zero beat.

Temporarily attach a 10-inch piece of wire to the end of R29 (22K) which connects to point "WW." Connect the other end of the wire to one of the on/off switch terminals. This will cause the antenna relay to close and the receiver to mute.

Realign the VFO as described in the Heathkit instruction manual, page 62

Remove the temporary wire and reinstall the cabinet cover. This completes the modification and alignment.

Robert W. Lewis, W3HVK

Editor's note: This article originally appeared in Ham Radio for November 1983 on page 103. That piece includes a helpful drawing to locate the parts called for in this modification. The drawing unfortunately could not be reproduced here.

#### DELAY CIRCUIT MOD

My HW-8 exhibited an excessively long rf output decay time. This resulted in choppy sounding CW at the higher keying speeds. Above about 25 WPM the output became a steady carrier even though the sidetone sounded good.

The problem was traced to the break-in delay circuit (fig.1). Capacitor C92 was discharging through Q12 causing keying transistor Q11 to remain in conduction for over 100 milli-seconds after the key was released. The solution was to reconfigure Q12 to function as an ordinary diode. When the key is up, Q12 is reverse biased, effectively disconnecting C92 from the keying circuit.

To make the modification, simply remove R66 and R67 (both 4700 ohms). Then solder a jumper wire between the base and collector of Q12. This modification had no noticeable effect on the break-in delay circuit or the setting of the delay control.

Robert Lewis, W3HVK

Ham Radio, August 1982

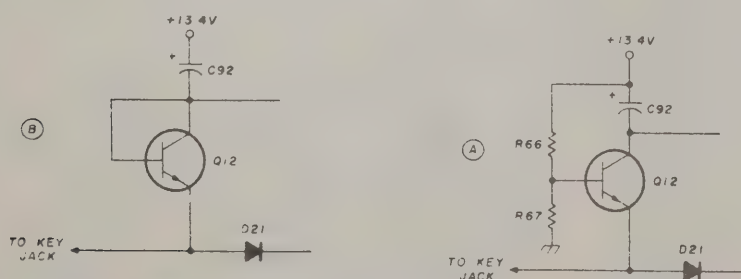


fig. 1. Original break-in delay circuit of the Heath HW-8. A. The improved circuit. B. eliminates choppy-sounding CW at higher keying speeds.

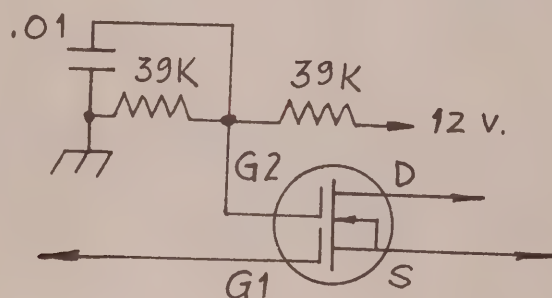
## NEW RECEIVER FRONT END

The HW-8 always struck me as insensitive to weak signals. Looking at the circuit, I realized that the product detector has a threshold (I don't know what it is) which relies solely on the front end FET (MPF105) for drive.

The MPF105 has a slope of only 2000 mho. Being annoyed at having to run the receiver full throttle af and rf all the time, I decided to use a modification suggested by the Fox Tango Club for the FT101B and change the first transistor to the 40673, with a slope of 11,000 mho.

I provided the necessary G2 voltage for this transistor via a potential divider from the 12 volt line. I now get the same output with the rf gain set at "8 o'clock" that I used to get at full throttle, not to mention that I now copy signals at S5 which I could not hear before. Even on 40 meters at night there is an improvement with the rf gain set down.

Hal Graepel, EI1DA



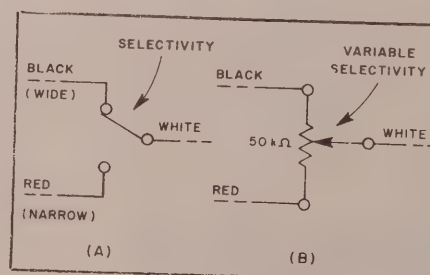
Editor's note: The addition of components may be done with the aid of a small terminal strip mounted on the PC board near the MPF105/40673. Others have found that substituting a 2N4416 for the MPF105 works almost as well as this mod but requires no extra components. The extra pin of the 2N4416 grounds the case, and it may be done with a small hole drilled into the PC board nearby the new unit, or the ground pin simply may be left "floating" with no noticeable loss in performance.

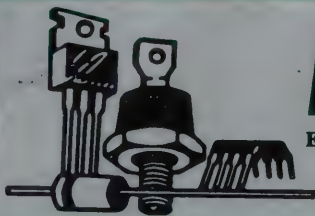
Either approach will produce a marked improvement in the HW-8.

## VARIABLE BANDWIDTH:

Replace the two-position selectivity switch with a variable resistor for a wide range of selectivity between wide and narrow.

Bill Ames, KA1EXB





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$g_{fs}$  - 5500 $\mu$ hos Typ  
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## A VARIABLE DRIVE CONTROL

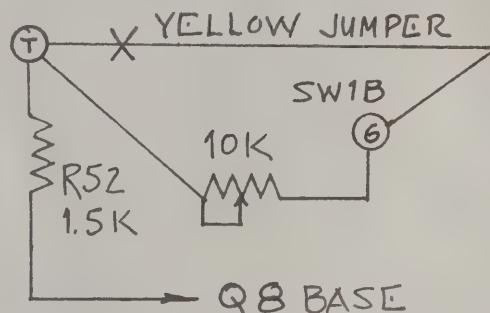
This device allows the HW-8 transmitter output to be varied from zero to full power, without affecting either receiver mixer injection or output loading. It is done by varying the bias on driver transistor Q8.

First, replace R52 (22K) with a 1.5K resistor. This was determined to be the maximum amount of resistance for minimum output. Remove the yellow jumper wire from point "T" on the circuit board to pin 6 on the 15 meter bandswitch. A front panel-mounted, 10K pot is wired in its place (see diagram). This pot can have a 5/8ths-inch maximum diameter and mounts below the meter and above the switch gang. A larger value pot could be used, but it was found that 10K gave the best resolution. That is, any more than 10K will not result in greater output.

The recommended location for the pot seems best, since it affords the shortest leads between point "T" and the bandswitch. I did not try other locations, and I suspect instability could occur with longer leads, as there is rf as well as dc in the circuit.

I would suggest to anyone trying this modification that component values be juggled, as I'm sure bias requirements for Q8 vary from unit to unit. Another HW-8 might require the full, original 22K of resistance.

John T. Collins, KN1H

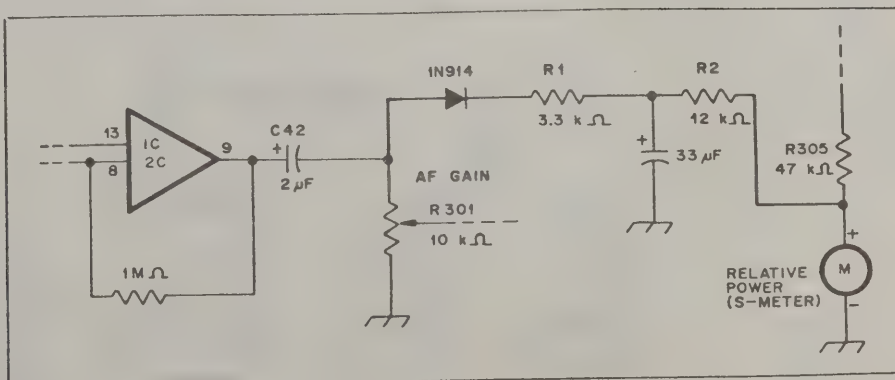


## AN "S" METER FOR THE HEATH HW-8

This mod makes up for the lack of an "S" meter but does not affect the operation of the meter in transmit. R2 was set to bring the meter near full scale on strong signals.

Kenneth Watters, WB7OVJ

Signal-strength meter modification for the HW-8 transceiver.



This bridge is based on the resistive bridge networks found in "Solid State Design for the Radio Amateur," by Doug DeMaw and Wes Hayward. It uses parallel resistors to increase the power handling capability and is built up on a small piece of circuit board which can easily be installed inside a QRP rig.

The circuit board is installed on a L-bracket which I attached to one of the mounting screws on the SO-239 antenna connector to keep leads short. The toggle switch is mounted in a hole between the antenna connector and the key jack. This switch interrupts the lead from the t/r relay to the antenna connector and inserts the bridge in the line for tuning.

Here are some good reasons for installing this bridge in your rig:

A dummy load and reflected power indicator go with you inside your rig; no extra junk to carry.

This bridge attenuates your transmitted signal during tune-up, thus reducing QRM

You can adjust portable antennas and transmatches without endangering your final, since a proper load is always presented to the transmitter.

It is so small that it fits inside most compact rigs or can be included in homebrew rig designs.

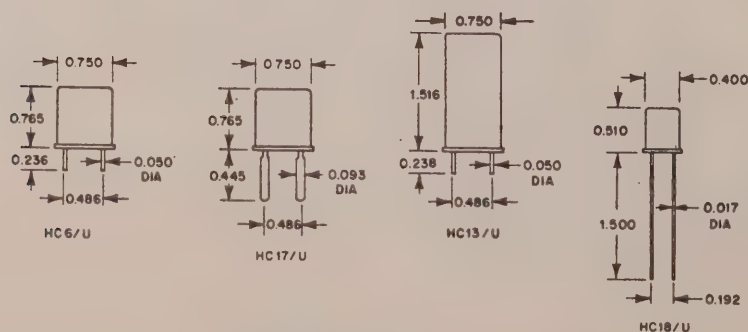
All parts are available at Radio Shack stores.

With a descriptive note about the bridge stapled inside the operating manual, the resale value of the rig is enhanced.

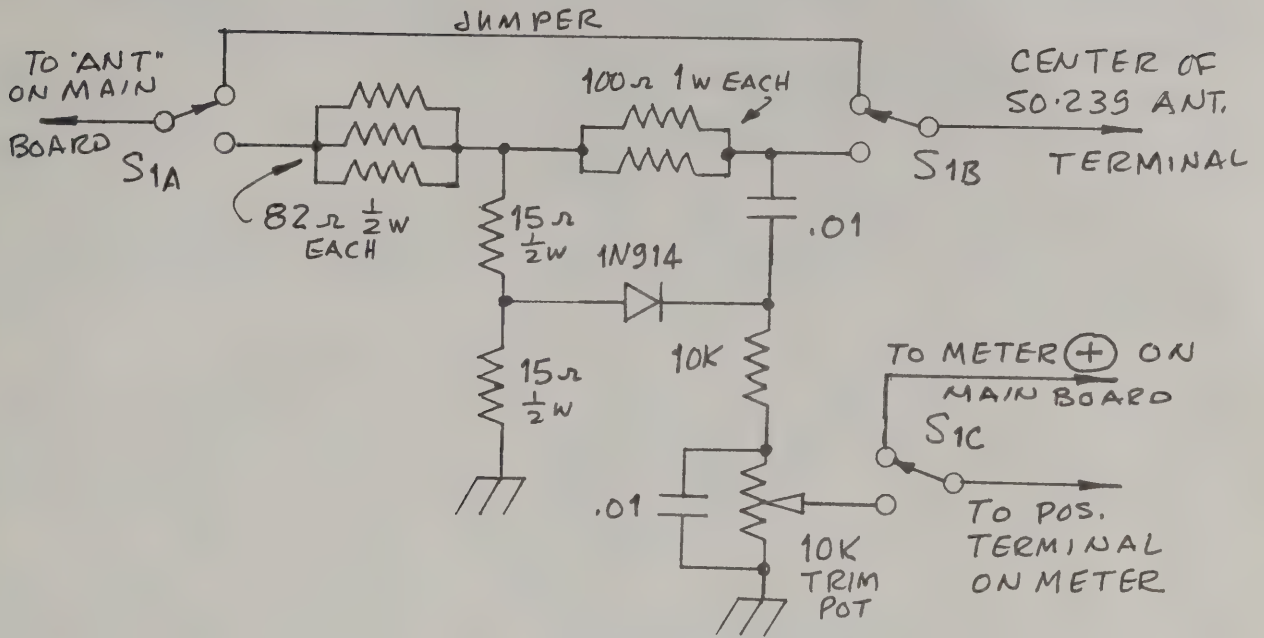
In operation, throw the 3PDT switch, and the bridge is placed between the transmitter and antenna connector. The rig's relative power output meter is "borrowed" for this bridge and is "returned" to normal functions when the bridge is bypassed for normal operations. The antenna can be disconnected from the rig to give a rough estimate of relative forward power when the bridge is in the circuit. The only adjustment is to remove the antenna and adjust the 10K trimpot so the meter reads what it normally would as a relative power meter with the bridge bypassed.

This resistive network bridge can easily handle 2 or 3 watts output. Even though it does not give a quantifiable reading of SWR, it very accurately shows when the antenna system is matched, and that is all that's necessary. With this bridge, my HW-7 reads 1.2:1 SWR at meter reading 1, 1.5:1 SWR at meter reading 2; and 2.5:1 SWR when the meter reads 3. You may want to substitute known resistances at the antenna connector and jot down a calibration chart for your meter after you build this handy little bridge.---Jerry Bartachek, KDOCA

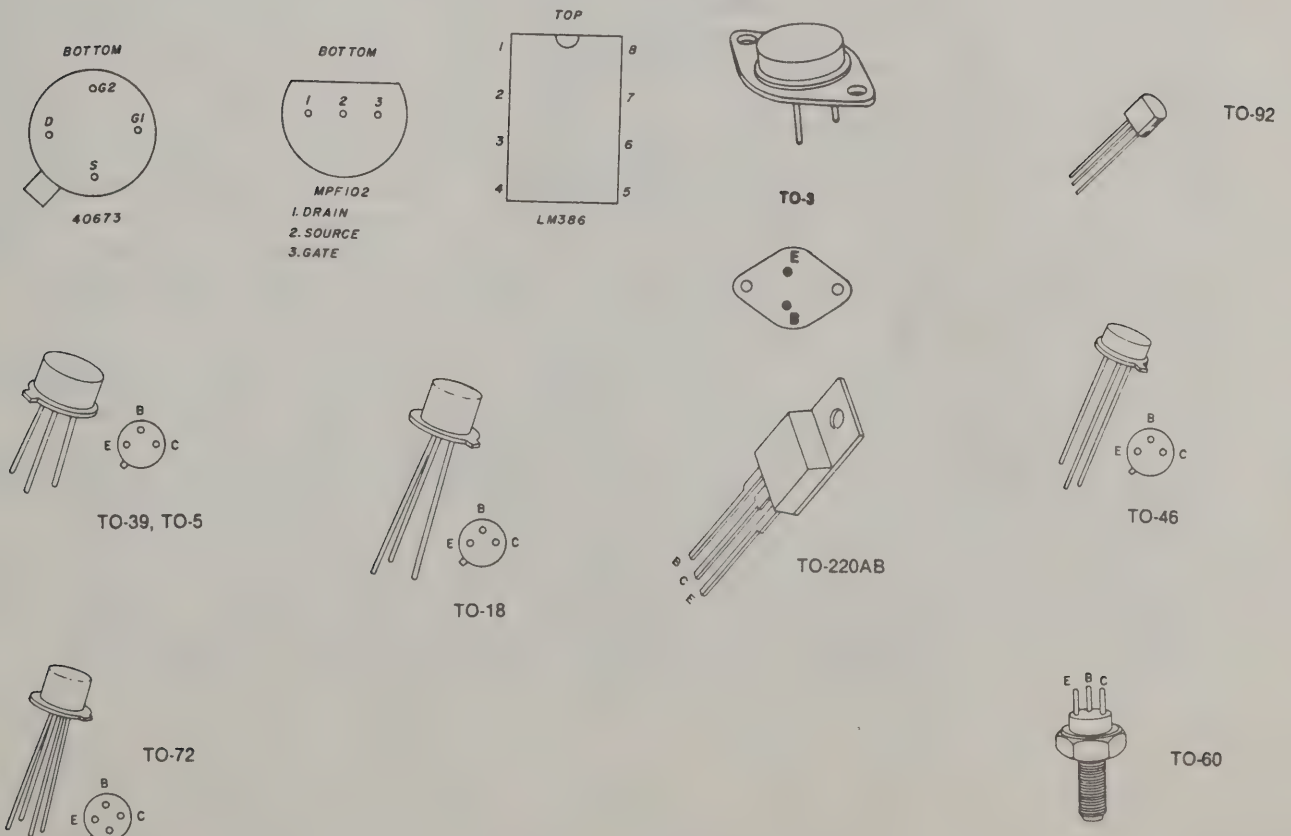
#### CRYSTAL HOLDERS



# TUNE-UP BRIDGE FOR HW-8 OR HW-7



## PINOUTS FOR SEMICONDUCTORS



1) VFO dial binding: Bending out the shield lips and experimenting with various locations for spot-soldering eliminated most of the binding. I finally removed the entire shield with no apparent spurious radiation problems. Heath confirms the same experience when the shield was removed.

2) Random VFO drift, both quantity and direction: Leaving the rig on constantly did not help. The drift had a mind of its own. Replaced all VFO components as resupplied by Heath. Tried my own polystyrene capacitors in the VFO circuit and purchased some new Sprague NPO disc ceramic capacitors, but the problem persisted. I concluded either the coil form and/or the slug was the source of the drift. Poured wax on the slug after setting it seemed to fix the problem.

3) Dial calibration: Install a Johnson 1.4 to 13 pf panel-mounted air variable capacitor on the front panel between the meter and the dial face (source was Circuit Specialists, part # 193-004-001). Carefully remove two plates from the rotor and the stator. I used a hobby razor saw for the job. Unless you have a knob that will fit the small shaft, you will have to build it up to accept a standard 1/4" knob. I used a Radio Shack, blue insert knob which is not only small but attractive (R.S. part #274-403). Connect the rotor and stator to point E and GND on the oscillator board and in parallel with C1. Carefully remove the trimmer from the VFO tuning capacitor, C1. Set your new panel variable to half scale and slightly adjust the slug in the VFO coil, L118, to bring WWV 10 MHz or your frequency counter setting of 5.9993 Mhz to correspond with zero on the tuning dial. Your panel variable will now compensate for exact frequency calibration up and down the band.

4) Frequency calibration: I bought a Ten-Tec Model 226 unit which used a 3.2 MHz crystal dividing down to 25 kHz points well into the HF range. I mounted the unit on the bottom side of the right in the area just behind the CW level control. I removed the 6-32 nut adjacent to the audio output coax connector and mounted a threaded metal spacer on the screw from which the nut was removed. The spacer is one inch high and is just right for the calibration oscillator to clear other components. The oscillator PCB is drilled in three places for mounting, and I used the rear hole for the other point of attachment. There I fabricated from PCB a bracket which I glued to the side chassis of the HW-9 and soldered to the oscillator board. Part of this fabrication included two pads to accommodate a 100-ohm, 1/2-watt resistor which drops the 9 volts from the HW-9 to the 7.35 volts used by the oscillator. From this resistor I ran a lead to a panel-mounted miniature toggle switch to control the on/off of the oscillator. I mounted the switch on the left side of the meter balancing the aforementioned variable. Use caution in locating the holes for these items and drill carefully to avoid scratching the panel. Since there is an inner chassis and outer panel, I mounted the variable and switch on the chassis and drilled a corresponding hole through the panel through which the switch and variable shaft protrude. From the switch I picked up 9 volts from the green wire from P101 on the HW-9 oscillator board.

Dick McIntyre, K4BNI, QRP Quarterly, April 1985

## HW-8 DIRECTORY FOR PARTS AND COMPONENTS

Here is a list of some known suppliers of parts and components for modifying the HW-8. No claims are made as to quality of parts or service offered by these suppliers.

Radio Kit	Circuit Board Specialist
Box 973	P.O. Box 969
Pelham, NH	Pueblo, CO
03076	81002

MHz Electronics	Caddell Coil Corp.
111 W. Camelback	35 Main Street
Phoenix, AZ	Poultney, VT
85015	05764

Active Electronics	Digi-Key
P.O.Box 1035	Hiway 32 South
Farmingham, NJ	P.O.Box 677
01701	Thief River Falls, SD
	56701

Jameco Electronics	Aldelco Electronics
1355 Shoreway road	2789 Milburn Ave
Belmont, CA	Baldwin, NY
94002	11510

Circuit Specialists	Ramsey Electronics
Box 3047	25 75 Baird Rd
Scottsdale, AZ	Penfield, NY
85257	14526

State Street Sales	DC Electronics
Box 249	Box 3203
Luther, MI	Scottsdale, AR
49656	85257

BCD Electro	Hosfelt Electronics Inc.
Box 830119	2610 Sunset Blvd
Richardson, TX	Steubenville, OH
75083-0119	43952

All Electronics	John J. Meshna Jr., Inc
Box 20406	19 Allerton St.
Los Angeles, CA	Lynn, MA
90006	01904

Your local Radio Shack Stores

## PART SUBSTITUTIONS

Throughout this handbook, various solid state devices are used. While it is best for the builder to use the device listed in the modifications, some substitution of parts may be permitted. This same thinking also goes for resistors and capacitors. One may change values plus or minus 10 percent and still have an operating circuit.

Listed below are some of the common transistors and diodes and a substituted for each. I have also tried to cross as many UK devices to US units as I could. This list is in no way complete. The USA parts numbers are RCA SK devices. ECG part numbers are the same.

UK	USA
BSY52	SK3024
BFY50	SK3104A
BFY51	SK3024
BC109	SK3444
BC107	SK3444
AF124	SK3006
AA117	SK3087
BC108	SK3444

DEVICE	USE	GENERIC
2N2222A	RS-2009	2N1167
2N3906		2N3905
2N3866	SK3195	4005-917
MRF476	SK3239	MRF475*
MPF102	SK3116	2N4116*
MJE180	SK3192	
2N4036	SK3025	
2N3819	SK3448	
2N4124	SK3854	
2N3904	SK3854	

\*Note: Not pin for pin direct substitution.

All "RS" numbers are Radio Shack.

Many of the "junk box" transistors are very leaky. This may cause some trouble with the RIT modification circuits. Use care when soldering up circuits using unknown devices.

## POSTSCRIPT

As the final touches are being put to this second edition of the Hot Water Handbook in late October, 1986, there are some interesting developments concerning the HW-8, not the least of which is that the price of these rigs on the used market has at last fallen below the \$75 mark. This is due largely to the introduction by Heath of the HW-9. At the same time, however, it enhances the availability of the HW-8 and makes it that much better as a buy for the QRP'er who still enjoys tinkering and experimenting.

Since most of the modifications in this handbook are based on work done by Adrian Weiss, WORSP, in his HW-8 modification series, it behooves us to tell you where and how to get a copy. It is available for \$7 (postpaid) from him at 83 Suburban Estates, Vermillion, South Dakota 57069.

While you are at it, order a copy of Ade's new book, The Joy of QRP: Strategy for Success. In addition to finding a well-written book on low-power operation, theory, practice and the like, you will find additional information on the HW-8 and how it operates. Copies are \$10.95 postpaid (11.95 for overseas orders) from: Milliwatt Books, 833 Duke Street #83 Vermillion, South Dakota 57069. Order separately from the HW-8 mod series.

Some of the modifications in this anthology are applicable also to the HW-7, HW-9 and to the Ten-Tec PM-3 and PM-3A transceivers. There is another work which contains considerably more material on modifications for the HW-7-- and which appear applicable to the PM series, too. It is the G-QRP Club Circuit Handbook, published originally by G-QRP Club in a limited edition which quickly sold out. The handbook has been added to the stable of first-class Amateur Radio publications now offered by the Radio Society of Great Britain (RSGB).

Copies may be obtained for 4.52 pounds, surface postage paid, from RSGB Publications (Sales), Alma House, Cranborn Road, Potters Bar, Herts EN6 3JW, England. Allow several weeks for delivery.

Finally, there are two leading QRP organizations which regularly publish modifications to the HW-8 and other low-power rigs. Examples of their work are on the preceding pages. For more information on membership, write:

QRP Amateur Radio Club International  
Publicity Manager  
Joe Sullivan, WA1WLU  
267 Sutton Street  
North Andover, Massachusetts 01845

Include a large, business-size SASE with 39 cents postage.

G-QRP Club  
Rev. George C. Dobbs G3RJV  
St. Aidan's Vicarage  
498 Manchester Road  
Rochdale, Lancs. OL11 3HE, England

Send along two IRCs.

Meanwhile, keep us in mind if you have any HW-8 modifications not included here but which you think would add to the next printing of the Hot Water Handbook.



# HEATHKIT<sup>®</sup> MANUAL

*for the*

## LOW-POWER CW TRANSCEIVER Model HW-8

595-1754-09



HEATH COMPANY • BENTON HARBOR, MICHIGAN

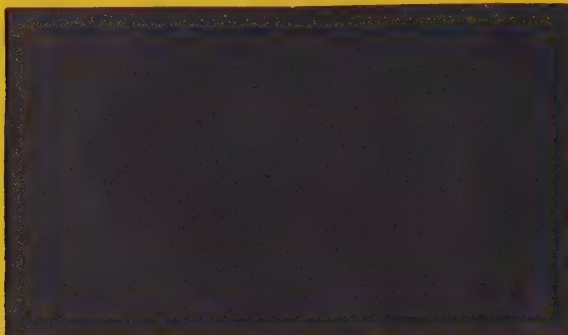
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Credit ..... (616) 982-3561  
Replacement Parts ..... (616) 982-3571

### *Technical Assistance Phone Numbers*

8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only  
R/C, Audio, and Electronic Organs ..... (616) 982-3310  
Amateur Radio ..... (616) 982-3296  
Test Equipment, Weather Instruments and  
Home Clocks ..... (616) 982-3315  
Television ..... (616) 982-3307  
Aircraft, Marine, Security, Scanners, Automotive,  
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We warrant that during the first ninety (90) days after purchase, our products, when correctly assembled, calibrated, adjusted and used in accordance with our printed instructions, will meet published specifications.

If a defective part or error in design has caused your Heathkit product to malfunction during the warranty period through no fault of yours, we will service it free upon proof of purchase and delivery at your expense to the Heath factory, any Heathkit Electronic Center (units of Schlumberger Products Corporation), or any of our authorized overseas distributors.

You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

Our warranty does not cover and we are not responsible for damage caused by: incorrect assembly, the use of corrosive solder, defective tools, misuse, or fire; or by unauthorized modifications to or uses of our products for purposes other than as advertised. Our warranty does not include reimbursement for inconvenience, loss of use, customer assembly or set-up time.

This warranty covers only Heathkit products and is not extended to allied equipment or components used in conjunction with our products. **We are not responsible for accidental or consequential damages.** Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

If you are not satisfied with our service (warranty or otherwise) or with our products, write directly to our Director of Customer Services, Heath Company, Benton Harbor, Michigan 49022. He will make certain your problems receive immediate, personal attention.

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# Heathkit® Manual

*for the*

## LOW-POWER CW TRANSCEIVER Model HW-8

595-1754-09

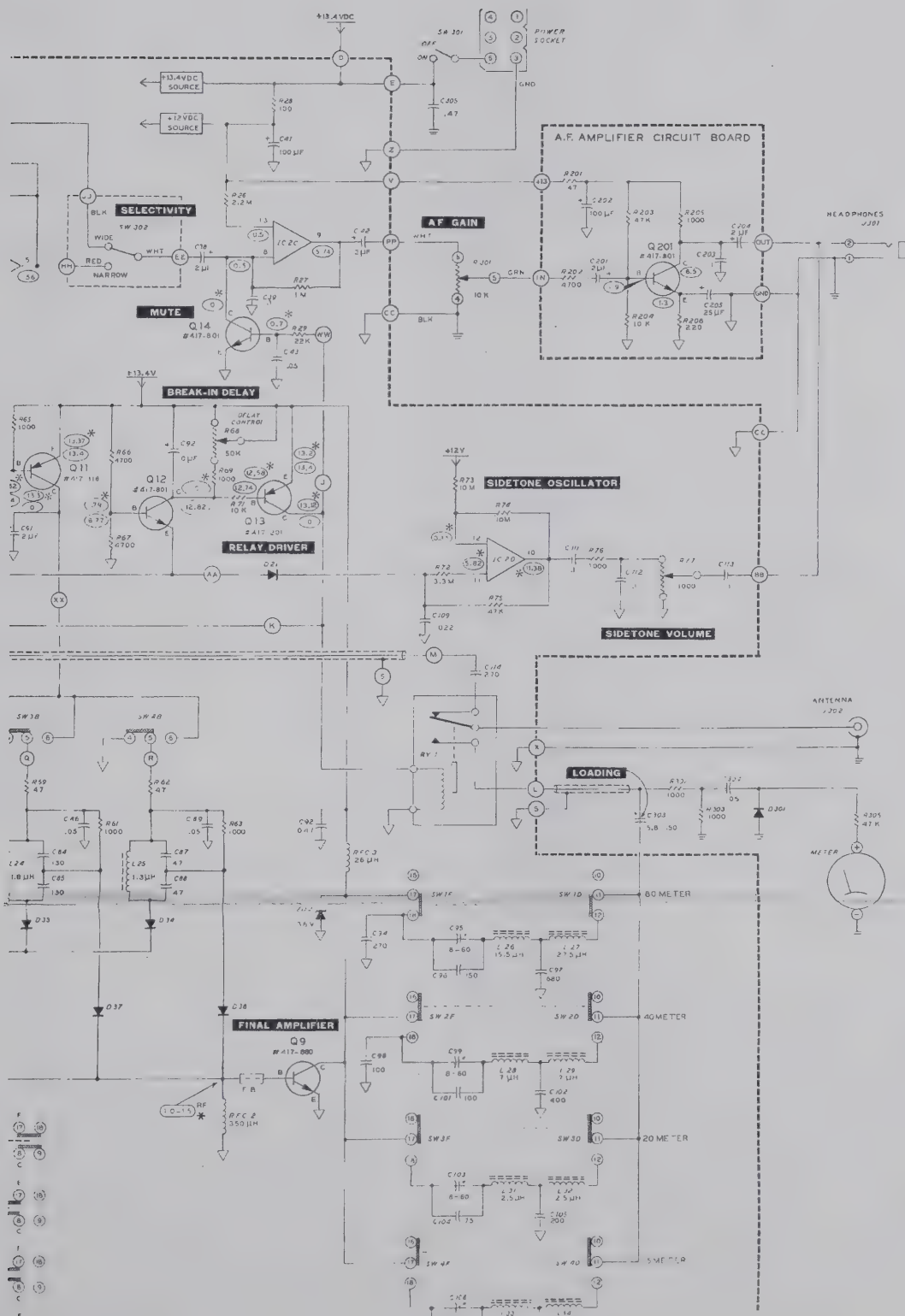


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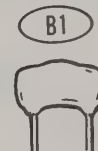


KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
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## CAPACITORS

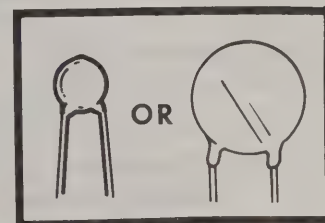
### Mica

B1	(✓)	1	24 pF	20-77	C123
B1	(✓)	5	47 pF	20-101	C71, C87, C88, C15, C121
B1	(✓)	2	68 pF	20-76	C1, C4
B1	(✓)	2	75 pF	20-110	C18, C104
B1	(✓)	6	100 pF	20-102	C61, C68, C98, C101, C107, C116
B1	(✓)	3	130 pF	20-104	C84, C85, C118
B1	(✓)	3	150 pF	20-103	C66, C96, C108
B1	(✓)	1	200 pF	20-108	C105
B1	(✓)	2	230 pF	20-111	C64, C82
B1	(✓)	2	270 pF	20-114	C94, C114
B1	(✓)	1	330 pF	20-139	C78
B1	(✓)	1	400 pF	20-116	C102
B1	(✓)	1	470 pF	20-128	C81
B1	(✓)	2	680 pF	20-107	C77, C97

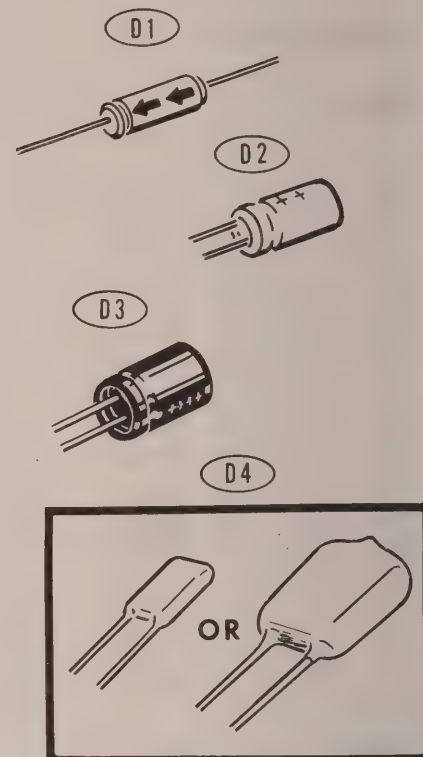


### Disc

C1	(✓)	4	3.3 pF	21-33	C12, C54, C73, C127
C1	(✓)	1	5 pF	21-157	C125
C1	(✓)	1	6 pF	21-169	C55
C1	(✓)	1	6.8 pF	21-703	C47
C1	(✓)	2	10 pF	21-3	C25, C126
C1	(✓)	1	27 pF	21-716	C48
C1	(✓)	2	56 pF	21-160	C49, C51
C1	(✓)	3	510 pF	21-191	C44, C45, C46
C1	(✓)	34	.05 $\mu$ F	21-143	C2, C5, C8, C11, C13, C14, C17, C21, C23, C28, C29, C43, C52, C56, C57, C58, C59, C62, C63, C65, C67, C69, C72, C75, C76, C79, C83, C86, C89, C115, C117, C119, C122, C128



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
<b>Other Capacitors</b>				
D1 (✓)	5	2 $\mu$ F electrolytic	25-123	C38, C42, C91, C201, C204
D1 (✓)	1	25 $\mu$ F electrolytic	25-96	C205
D2 (✓)	2	10 $\mu$ F electrolytic	25-115	C33, C92
D3 (✓)	3	100 $\mu$ F electrolytic	25-117	C32, C41, C202
D4 (✓)	1	.022 $\mu$ F Mylar	27-63	C109
D4 (✓)	9	.1 $\mu$ F Mylar	27-47	C26, C27, C31, C39, C74, C111, C112, C113, C203
D4 (✓)	1	.47 $\mu$ F Mylar	27-86	C93
D5 (✓)	2	1000 pF polystyrene	29-5	C36, C37
D5 (✓)	2	1800 pF, (1.8n) poly- styrene	29-4	C34, C35
D6 (✓)	1	4.7 pF ceramic	21-29	C53
D7 (✓)	3	4 to 40 pF trimmer	31-54	C6, C16, C19
D7 (✓)	9	8 to 60 pF trimmer	31-52	C3, C7, C9, C22, C24, C95, C99, C103, C106

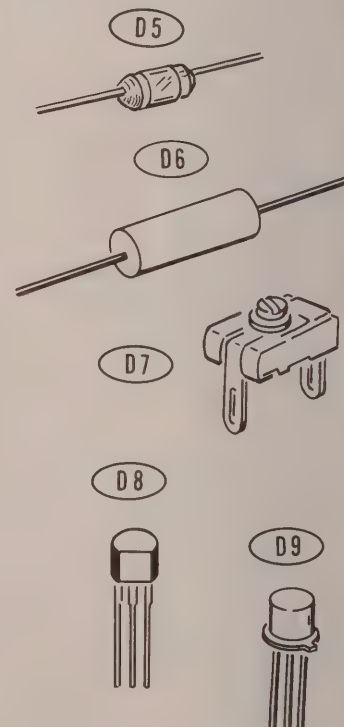


## TRANSISTORS – INTEGRATED CIRCUITS (IC's)

NOTE: Transistors and IC's are marked for identification in one of the following ways:

1. Part number.
2. Type number. (On integrated circuits this refers only to the numbers; the letters may be different or missing.)
3. Part number and type number.
4. Part number and a type number other than the one listed.

D8 (✓)	2	MPF105 transistor (JFET)	417-169	Q1, Q2
D8 (✓)	6	MPS-A20 transistor	417-801	Q3, Q5, Q7, Q12, Q14, Q201
D8 (✓)	1	S2091 transistor	417-116	Q11
D9 (✓)	1	40673 transistor (MFET)	417-240	Q4

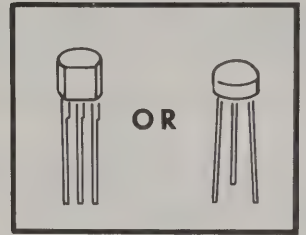


KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

### Transistors-Integrated Circuits (IC's)

D10 (✓)	2	MPS6521 transistor	417-172	Q6, Q8
D11 (✓)	1	2N4427 transistor	417-880	Q9
D12 (✓)	1	X29A829 transistor	417-201	Q13
D13 (✓)	1	MC1496G IC (inte- grated circuit)	442-96	IC1
D14 (✓)	1	LM3900	442-71	IC2

D10



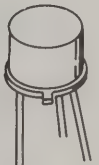
### CRYSTALS

D15 (✓)	1	12.395 MHz	404-207	Y1
D15 (✓)	1	15.895 MHz	404-208	Y2
D15 (✓)	1	22.895 MHz	404-209	Y3
D15 (✓)	1	29.895 MHz	404-210	Y4

D12



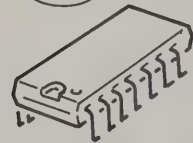
D11



D13



D14



D15

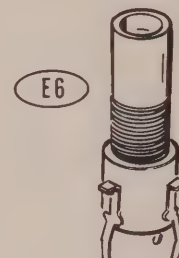
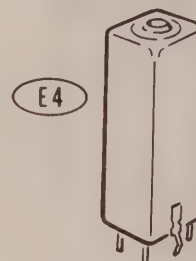
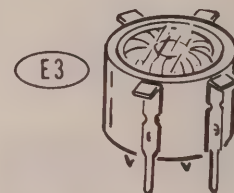


KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
D16 (✓)	1	1000 $\Omega$ control	10-936	R77
D16 ( )	1	50 k $\Omega$ control	10-222	R68



CAUTION: Do not remove the coils or chokes from their envelopes until they are called for in a step.

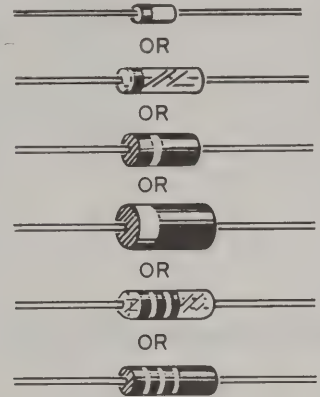
E1 (✓)	4	1.3 $\mu$ H toroid coil	40-1800	L8, L25, L33, L34
E1 (✓)	2	1.8 $\mu$ H toroid coil	40-1792	L7, L24
E1 (✓)	2	2.5 $\mu$ H toroid coil	40-1609	L31, L32
E1 (✓)	2	4.2 $\mu$ H toroid coil	40-1798	L6, L23
E1 (✓)	2	7.0 $\mu$ H toroid coil	40-1726	L28, L29
E1 (✓)	1	9.0 $\mu$ H toroid coil	40-1797	L22
E1 (✓)	2	15.5 $\mu$ H toroid coil	40-1882	L5, L26
E1 (✓)	1	27.5 $\mu$ H toroid coil	40-1791	L27
E2 (✓)	2	15.0 $\mu$ H toroid coil	40-1050	L11, L12
E3 (✓)	2	1.8 $\mu$ H toroid coil	40-1788	L3, L4
E3 (✓)	1	4.7 $\mu$ H toroid coil	40-1787	L2
E3 (✓)	1	13.0 $\mu$ H toroid coil	40-1786	L1
E4 (✓)	1	.83 $\mu$ H coil	40-1804	L19/L21
E4 (✓)	1	1.47 $\mu$ H coil	40-1803	L17/L18
E5 (✓)	1	4.0 $\mu$ H coil	40-1795	L14
E5 (✓)	2	1.3 $\mu$ H coil	40-1796	L15, L16
E5 (✓)	1	8.0 $\mu$ H coil	40-1794	L13
E6 (✓)	1	5.0 $\mu$ H coil	40-1802	L9
E7 ( )	1	26.0 $\mu$ H choke	45-62	RFC3
E8 ( )	2	350 $\mu$ H choke	45-82	RFC1, RFC2



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
<b>DIODES</b>				
E9 (✓)	1	VR-9.1 zener	56-19	ZD1
E9 (✓)	1	VR-36 zener	56-55	ZD2
E9 (✓)	4	FH1100	56-87	D12, D13, D14, D15
E9 (✓)	23	1N458	56-24	D1, D2, D3, D4, D5, D6, D7, D8, D9, D11, D16, D17, D18, D19, D21, D31, D32, D33, D34, D35, D36, D37, D38
E9 (✓)	8	1N4149	56-56	D22, D23, D24, D25, D26, D27, D28, D29

E9

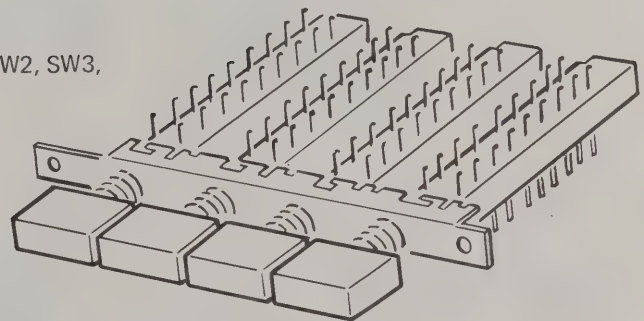
NOTE: HEATH PART NUMBERS  
ARE STAMPED ON MOST DIODES.



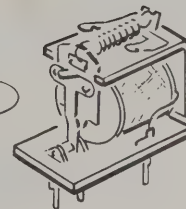
**MISCELLANEOUS**

E10 (✓)	1	Pushbutton switch assembly	64-775	SW1, SW2, SW3, SW4
E11 (✓)	1	Relay	69-47	RY1
E12 (✓)	1	Heat sink	215-45	
E13 (✓)	1	IC socket	434-298	
E14 (✓)	1	Ferrite bead	475-10	

E10



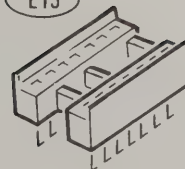
E11



E12

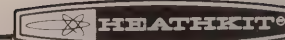


E13



E14





KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

## Miscellaneous (cont'd.)

E15	( )	3	Cable tie	354-5
E16	( )	4	6-32 x 1/4" screw	250-56
E17	( )	3	6-32 nut	252-3
E18	( )	4	#6 lockwasher	254-1
E19	( )	1	6-32 x 1/2" spacer	255-23



E16



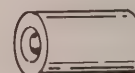
E17



E18



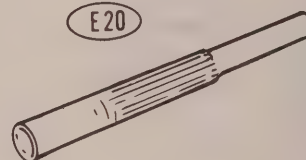
E19



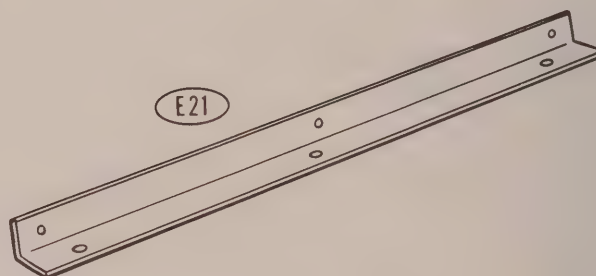
## PARTS FROM FINAL PACK

E20	( )	1	Nut starter	490-5
E21	( )	1	Angle bracket	204-1844
	( )	11'	Yellow wire	344-54
	( )	5'	5-wire cable	347-39
	( )	6'	Shielded cable	343-15
	( )	1	Main circuit board	85-1748-5
	( )	1	AF Amplifier circuit board	85-1677-1
	( )		Solder	

E20



E21

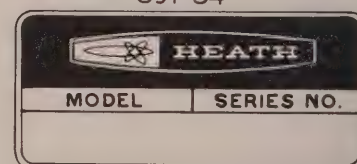


## PRINTED MATERIAL

NOTE: Be sure you refer to the numbers on the blue and white label in any communications you may have about this kit with Heath Company. You may want to write the model and series numbers in the sample label for future convenience.

( )	1	Blue and white label	391-34
( )	1	Parts Order Form	597-260
( )	1	Kit Builders Guide	597-308
( )	1	Manual (See front cover for part number.)	

391-34

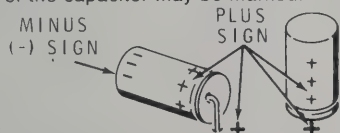


# STEP-BY-STEP ASSEMBLY

## START

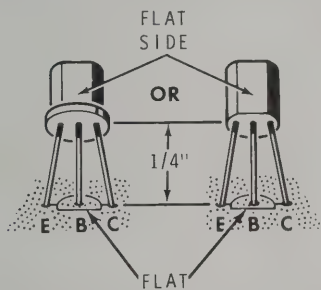
Position the AF Amplifier circuit board as shown. Then perform the steps in the order listed.

**NOTE:** When you install an electrolytic capacitor, always connect the lead at the positive (+) end of the capacitor to the positive (+) marked point on the circuit board. Be careful, only the negative end of the capacitor may be marked.



(✓) C205: 25  $\mu$ F electrolytic.

**NOTE:** When you install the following transistor, line up the flat on the transistor with the outline of the flat on the circuit board. Then insert the E, B, and C leads of the transistor into the corresponding E, B, and C holes in the circuit board. Position the transistor 1/4" above the circuit board, solder the leads to the foil, and cut off the excess lead lengths.



(✓) Q201: MPS-A20 transistor (#417-801).

(✓) C204: 2  $\mu$ F electrolytic.

( ) R201: 47  $\Omega$  (yellow-violet-black).

(✓) R202: 4700  $\Omega$  (yellow-violet-red).

( ) C201: 2  $\mu$ F electrolytic.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

FOR GOOD SOLDER CONNECTIONS, YOU MUST **KEEP THE SOLDERING IRON TIP CLEAN.**

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



## CONTINUE

(✓) R206: 220  $\Omega$  (red-red-brown).

(✓) C203: .1  $\mu$ F Mylar.

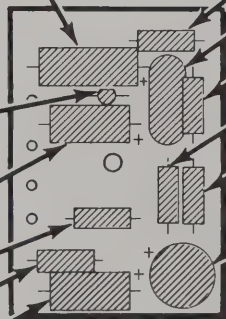
(✓) R204: 10 k $\Omega$  (brown-black-orange).

(✓) R205: 1000  $\Omega$  (brown-black-red).

(✓) R203: 47 k $\Omega$  (yellow-violet-orange).

(✓) C202: 100  $\mu$ F electrolytic.

( ) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 1-1

**START** 

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



NOTE: When you prepare the wires in the following steps, cut the wire to the length specified in the step and remove 1/4" of insulation from each end. Solder one end of each wire to the foil and cut off the excess wire lengths.

( ✓ ) 2" yellow wire.

( ✓ ) 2-3/4" yellow wire.

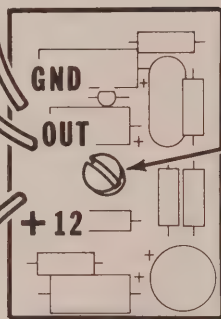
( ) 3" yellow wire.

NOTE: The hole marked "IN" on the circuit board will be used later.

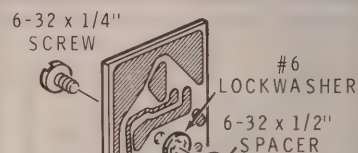
2-3/4"  
YEL

2"  
YEL

3"  
YEL

**CONTINUE** 

CAUTION: When you perform the next step, be sure the lockwasher does not touch the adjacent foil.



FOIL SIDE  
OF  
CIRCUIT BOARD

( ) Mount a 6-32 x 1/2" spacer on the foil side of the circuit board as shown above.

**CIRCUIT BOARD CHECKOUT**

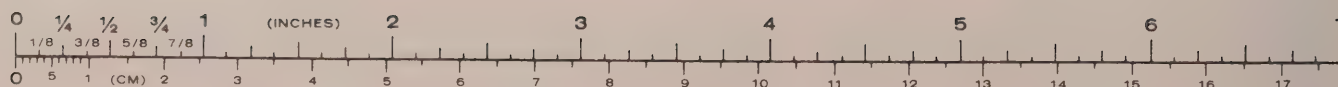
Carefully inspect the circuit board for the following conditions.

- ( ✓ ) Unsoldered connections.
- ( ✓ ) "Cold" solder connections.
- ( ) Solder bridges between foil patterns.
- ( ) Protruding leads which could touch together.
- ( ✓ ) Transistors for the proper type and installation.
- ( ) Electrolytic capacitors for the correct position of the positive (+) lead.

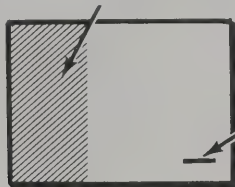
Set the circuit board aside until it is called for later.

**FINISH**

PICTORIAL 1-2



The steps performed in this Pictorial are in this area of the circuit board.

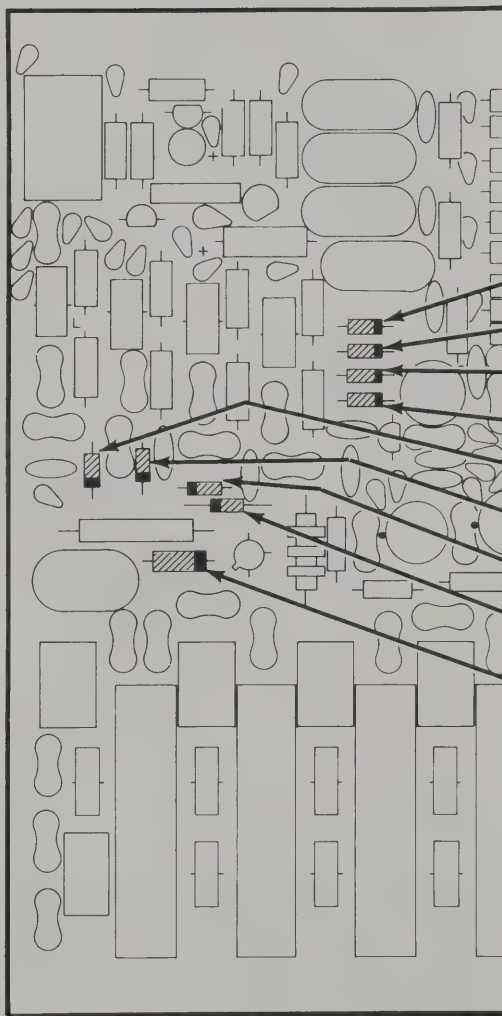
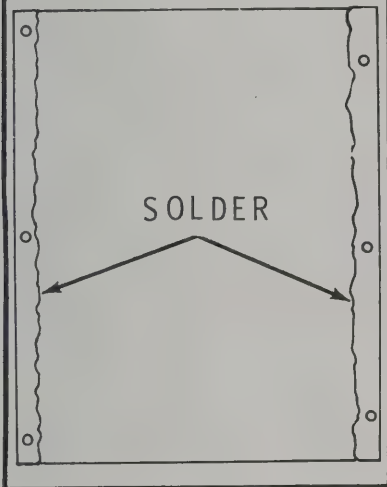


PART  
NUMBER

IDENTIFICATION  
DRAWING

## START

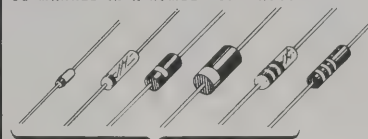
Position the main circuit board foil-side-up as shown below. Then apply a thin coating of solder along the indicated edges of the circuit board. This will assure a good ground connection when the circuit board is mounted later.



## CONTINUE

Position the main circuit board component side up as shown. Then perform the steps in the order listed.

**IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.**



**BANDED END**

BE SURE YOU INSTALL EACH DIODE SO ITS BANDED END IS POSITIONED AS SHOWN IN THE PICTORIAL.

Install eight 1N458 diodes (#56-24).

(+) D34.

(.) D33.

(.) D32.

(+) D31.

(.) D35.

(.) D36.

(+) D37.

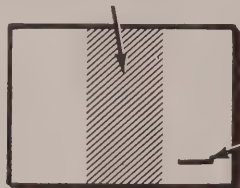
(+) D38.

(✓) ZD2: VR-36 zener diode (#56-55).

(✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-1

The steps performed in this Pictorial are in this area of the circuit board.



PART  
NUMBER

IDENTIFICATION  
DRAWING

**START** ➡

**FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.**

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



Install eight 1N4149 diodes (#56-56).

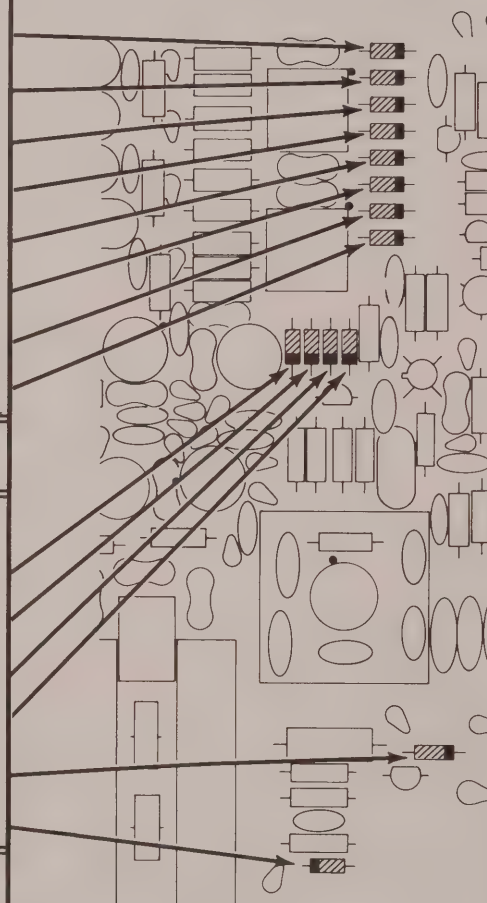
- ( ) D23. ....
- ( ) D22. ....
- ( ) D24. ....
- ( ) D25. ....
- ( ) D26. ....
- ( ) D29. ....
- ( ) D27. ....
- ( ) D28. ....

( ) Solder the leads to the foil and cut off the excess lead lengths.

Install six 1N458 diodes (#56-24).

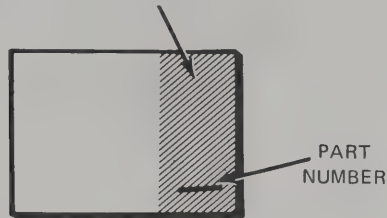
- ( ) D16. ....
- ( ) D17. ....
- ( ) D18. ....
- ( ) D19. ....
- ( ) D9. ....
- ( ) D11. ....

( ) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 2-2

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION  
DRAWING

### START

(✓) D21: 1N458 diode (#56-24).

Install four FH1100 diodes (#56-87).

(+) D12. . . . .

(-) D13. . . . .

(-) D15. . . . .

(-) D14. . . . .

Install two 1N458 diodes (#56-24).

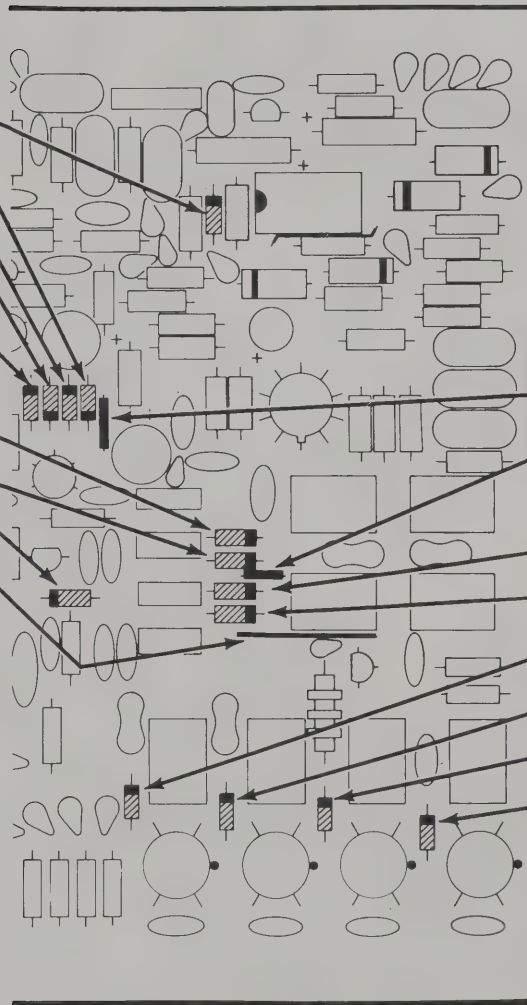
(-) D8. . . . .

(-) D7. . . . .

(✓) ZD1: VR-9.1 zener diode (#56-19).

(✓) 1-1/2" yellow wire at J.

(✓) Solder the leads to the foil and cut off the excess lead lengths.



### CONTINUE

(✓) 1" yellow wire at J.

(✓) 1" yellow wire at J.

Install six 1N458 diodes (#56-24).

(✓) D6.

(-) D5.

(-) D1.

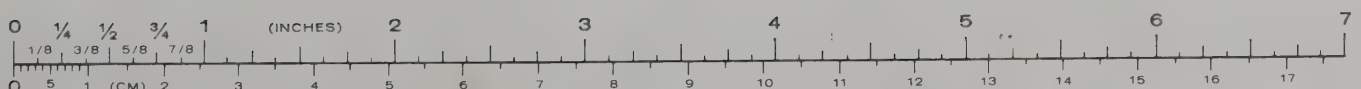
(-) D2.

(-) D3.

(-) D4.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-3



The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION  
DRAWING

### START

FOR GOOD SOLDER CONNECTIONS, YOU MUST **KEEP THE SOLDERING IRON TIP CLEAN.**

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



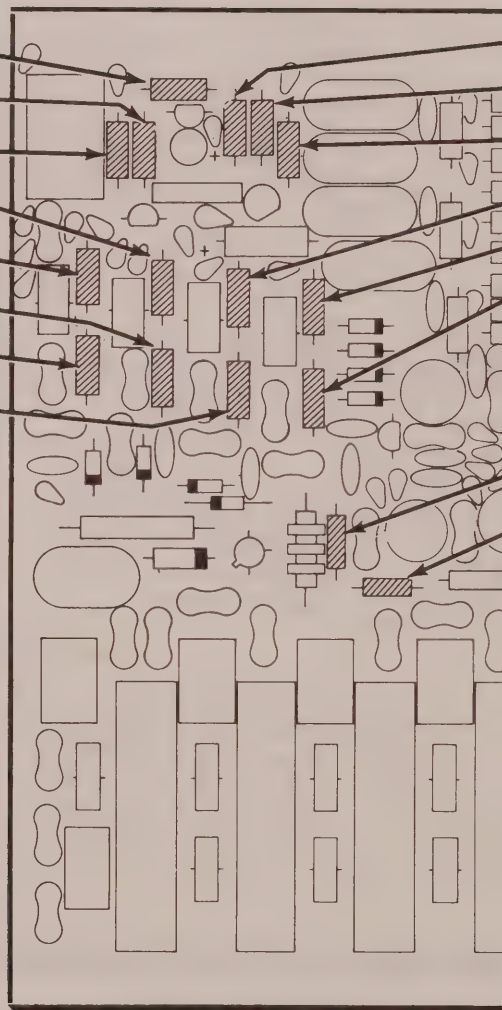
- ( ) R67: 4700  $\Omega$  (yellow-violet-red).
- ( ) R69: 1000  $\Omega$  (brown-black-red).
- ( ) R71: 10 k $\Omega$  (brown-black-orange).
- ( ) R57: 47  $\Omega$  (yellow-violet-black).
- ( ) R54: 47  $\Omega$  (yellow-violet-black).
- ( ) R58: 1000  $\Omega$  (brown-black-red).
- ( ) R56: 470  $\Omega$  (yellow-violet-brown).
- ( ) R61: 1000  $\Omega$  (brown-black-red).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

### CONTINUE

- ( ) R66: 4700  $\Omega$  (yellow-violet-red).
- ( ) R64: 4700  $\Omega$  (yellow-violet-red).
- ( ) R65: 1000  $\Omega$  (brown-black-red).
- ( ) R59: 47  $\Omega$  (yellow-violet-black).
- ( ) R62: 47  $\Omega$  (yellow-violet-black).
- ( ) R63: 1000  $\Omega$  (brown-black-red).



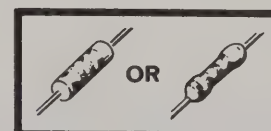
- ( ) R55: 100  $\Omega$  (brown-black-brown).
- ( ) R53: 4700  $\Omega$  (yellow-violet-red).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 2-4

KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
<b>RESISTORS (cont'd.)</b>				
A1 (✓)	19	1000 $\Omega$ (brown-black-red)	6-102	R1, R2, R3, R4, R7, R8, R12, R36, R58, R61, R63, R65, R69, R76, R78, R82, R85, R88, R205
A1 (✓)	1	1200 $\Omega$ (brown-red-red)	6-122	R9
A1 (✓)	2	2700 $\Omega$ (red-violet-red)	6-272	R16, R17
A1 (✓)	1	3300 $\Omega$ (orange-orange-red)	6-332	R92
A1 (✓)	5	4700 $\Omega$ (yellow-violet-red)	6-472	R53, R64, R66, R67, R202
A1 (✓)	4	6800 $\Omega$ (blue-gray-red)	6-682	R79, R83, R86, R89
A1 (✓)	4	10 k $\Omega$ (brown-black-orange)	6-103	R15, R50, R71, R204
A1 (✓)	4	22 k $\Omega$ (red-red-orange)	6-223	R29, R37, R52, R95
A1 (✓)	6	47 k $\Omega$ (yellow-violet-orange)	6-473	R19, R44, R47, R48, R75, R203
A1 (✓)	2	68 k $\Omega$ (blue-gray-orange)	6-683	R38, R94
A1 (✓)	2	82 k $\Omega$ (gray-red-orange)	6-823	R21, R24
A1 (✓)	7	100 k $\Omega$ (brown-black-yellow)	6-104	R5, R43, R45, R81, R84, R87, R91
A1 (✓)	2	470 k $\Omega$ (yellow-violet-yellow)	6-474	R22, R23
A1 (✓)	3	1 M $\Omega$ (brown-black-green)	6-105	R25, R27, R32
A1 (✓)	1	2.2 M $\Omega$ (red-red-green)	6-225	R26
A1 (✓)	1	3.3 M $\Omega$ (orange-orange-green)	6-335	R72
A1 (✓)	2	10 M $\Omega$ (brown-black-blue)	1-40	R73, R74

A1



# CIRCUIT BOARD

## PARTS LIST

Open the container marked PTS #1 and check each part against the following list. You will also be instructed to remove some of the other parts that are left in the carton. These parts will be referred to as the "Parts From Final Pack." Make a check (✓) in the space provided as you identify each part. The illustrations show what the part looks like. Only the hardware is shown actual size.

Some parts are packaged in containers with the part number marked on the outside. Except for the initial parts check, keep these parts in their containers so they can be easily identified when they are called for in the assembly steps.

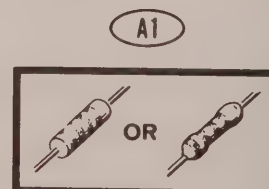
To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with the kit. If one is not available, see "Replacement Parts" inside the rear cover of this Manual. Your Warranty is located inside the front cover. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

### RESISTORS

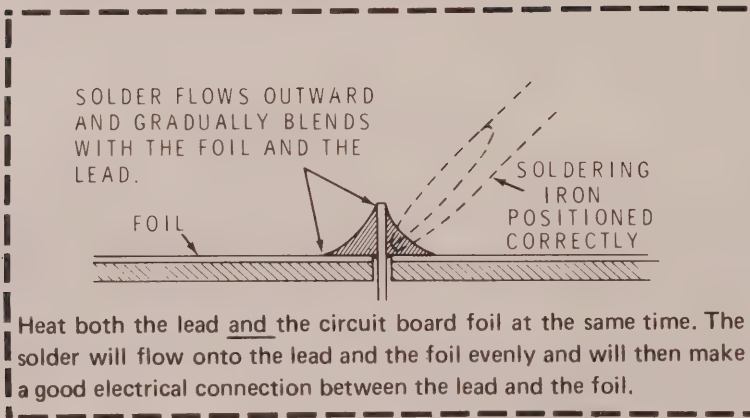
NOTE: Resistors may be packed in more than one envelope. All resistors are 1/2-watt, 10% tolerance (silver fourth band) unless otherwise stated.

A1	(✓)	7	47 $\Omega$ (yellow-violet-black)	6-470	R13, R31, R54, R57, R59, R62, R201
A1	(✓)	10	100 $\Omega$ (brown-black-brown)	6-101	R14, R18, R28, R39, R41, R42, R46, R51, R55, R96
A1	(✓)	1	220 $\Omega$ (red-red-brown)	6-221	R206
A1	(✓)	2	270 $\Omega$ (red-violet-brown)	6-271	R6, R49
A1	(✓)	5	470 $\Omega$ (yellow-violet-brown)	6-471	R33, R34, R35, R56 R93
A1	(✓)	1	820 $\Omega$ (gray-red-brown)	6-821	R11



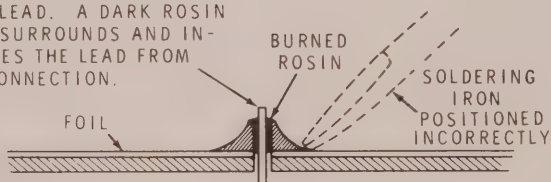


### A GOOD SOLDER CONNECTION



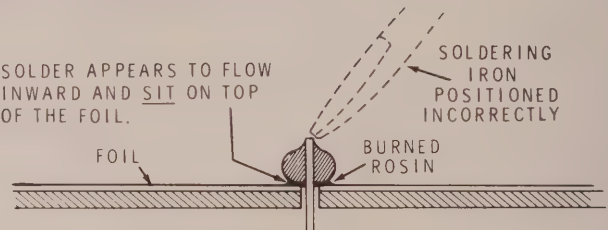
### BAD SOLDER CONNECTIONS

SOLDER DOES NOT FLOW ONTO LEAD. A DARK ROSIN BEAD SURROUNDS AND INSULATES THE LEAD FROM THE CONNECTION.



When the lead is not heated sufficiently, the solder will not flow onto the lead as shown above. Reheat the connection and, if necessary, apply a small amount of additional solder to obtain a connection as shown under "A Good Solder Connection."

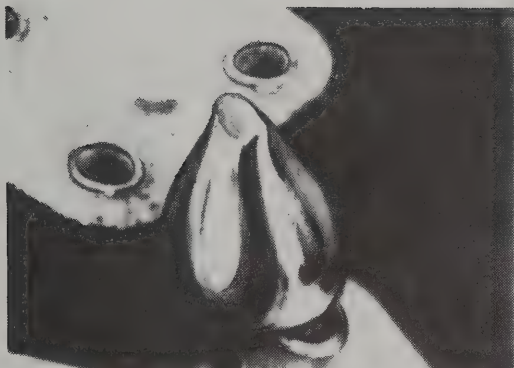
SOLDER APPEARS TO FLOW INWARD AND SIT ON TOP OF THE FOIL.



When the foil is not heated sufficiently, the solder will blob on the circuit board as shown above. Reheat the connection and, if necessary, apply a small amount of additional solder to obtain a connection as shown under "A Good Solder Connection."

## SOLDERING INSTRUCTIONS

Poor soldering accounts for about 90% of all kit building problems. The following photographs show examples of the types of bad solder connections that are the most common cause of trouble. If you locate any of these bad solder connections in your kit, correct them as instructed. Study this section carefully before you begin to assemble your kit.



In this case, the solder was applied to the lead but did not flow onto the foil. To correct, reheat the connection.



Here, solder has flowed along a lead and bridged to another foil. To correct, hold the circuit board above the soldering iron and reheat the solder. As the solder melts, it will flow down the iron. Then cut off the excess lead length. **PROTECT YOUR EYES.**



Here, hot solder has been dropped onto the foil and the solder connected or bridged (or crossed) three foils. To correct, hold the circuit board above the soldering iron and reheat the solder. As the solder melts, it will flow down the iron. **PROTECT YOUR EYES.**

**NOTE:** Solder that bridges two connections on the **SAME FOIL** is alright and should not be corrected.

Keep the soldering iron tip clean by wiping it from time to time with a damp sponge or cloth.

# ASSEMBLY NOTES

A separate "Illustration Booklet" contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. The illustrations are arranged in Pictorial number sequence. Place the Booklet in a convenient location and keep it with the Assembly Manual.

Each circuit part has its own component number (R2, C4, L3, etc.). Use these numbers when you want to identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:

- In the parts list,
- At the beginning of each step where a component is installed,
- In some illustrations,

- In the Schematic,
- In the sections at the rear of the Manual.

Before you start to assemble this kit, read the wiring and soldering information in the "Kit Builders Guide."

Resistors are identified by their value in ohms ( $\Omega$ ), kilohms ( $k\Omega$ ) or megohms ( $M\Omega$ ) and by color code.

Capacitors are identified by their type (disc, Mylar\*, electrolytic, tuning, trimmer, or polystyrene), and capacitance value in  $\mu F$  or pF.

\*Registered DuPont Trademark.



# INTRODUCTION

The Heathkit Model HW-8 Transceiver is a solid-state, four-band QRP (low power) unit covering the CW portion of the eighty, forty, twenty, and fifteen meter amateur bands. The direct-conversion receiver features an RF stage, a balanced product detector, and an active audio filter with wide or narrow selectivity.

Other features include diode band switching which is controlled by pushbuttons and a method of premixing the variable and heterodyne oscillator signals to provide the same dial read-out on all bands. This also provides excellent stability and a fixed frequency offset on all bands while you are transmitting.

In addition to indicating Relative Power, the panel meter is used during alignment to assure proper adjustment of the transmitter tuned circuits.

The HW-8 Transceiver may be operated from the Heathkit Accessory Power Supply Model HWA-7-1, an equivalent low impedance power supply, or from batteries.

*Refer to the "Kit Builders Guide" for information on tools, wiring, soldering, resistors, and capacitors.*

**FOR PARTS REQUESTS ONLY**

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

**DO NOT WRITE IN THIS SPACE****INSTRUCTIONS**

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, \$3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.  
Total enclosed \$ \_\_\_\_\_
- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_ ZIP \_\_\_\_\_

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # \_\_\_\_\_ Invoice # \_\_\_\_\_  
Date \_\_\_\_\_ Location \_\_\_\_\_  
Purchased \_\_\_\_\_ Purchased \_\_\_\_\_

LIST <b>HEATH</b> PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE

TOTAL FOR PARTS

HANDLING AND SHIPPING

MICHIGAN RESIDENTS ADD 4% TAX

TOTAL AMOUNT OF ORDER

SEND TO: **HEATH COMPANY**  
BENTON HARBOR  
MICHIGAN 49022  
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY  
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

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Total enclosed \$ \_\_\_\_\_
- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_ ZIP \_\_\_\_\_

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Purchased \_\_\_\_\_ Purchased \_\_\_\_\_

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THIS FORM IS FOR U.S. CUSTOMERS ONLY  
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR



The steps performed in this Pictorial are in this area of the circuit board.

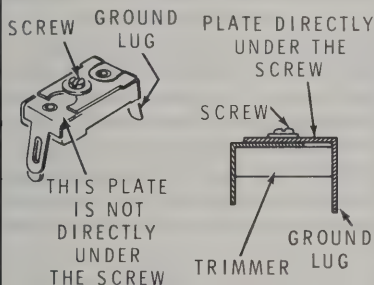


IDENTIFICATION  
DRAWING

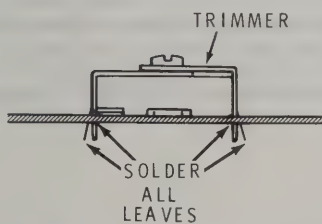
## START

### NOTES:

1. You will install four trimmer capacitors on the circuit board in the following steps. Note that there are two different values of trimmers.
2. Some of the trimmer lugs have two or more leaves. When you install the trimmer, make sure all of the lug leaves go through the circuit board.
3. IT IS VERY IMPORTANT to solder the correct trimmer lug to the correct foil. One lug on each trimmer will be called the ground lug. This is the lug that is connected to the metal plate directly under the screw on the trimmer.



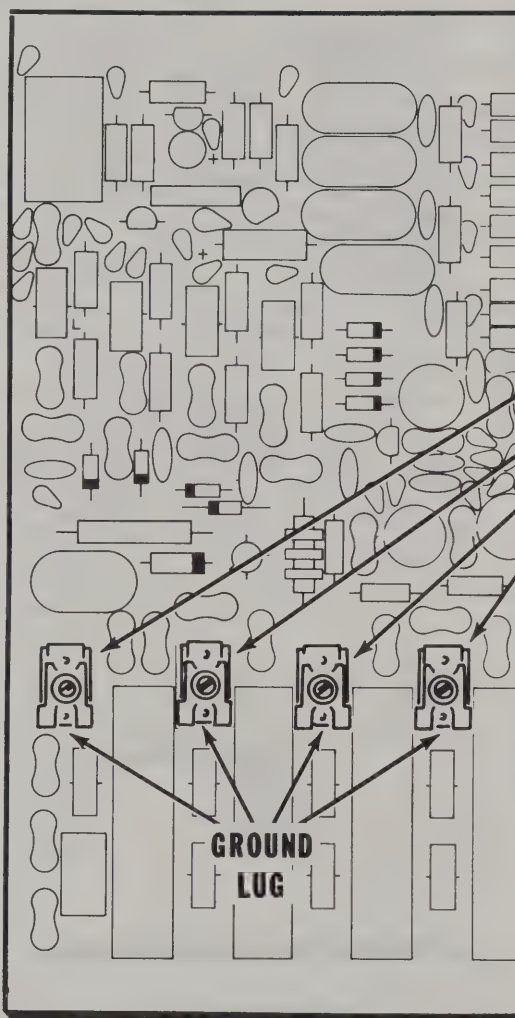
4. Make sure that each trimmer capacitor is properly positioned and soldered to the foil. If a trimmer lug has more than one leaf, make sure all leaves are soldered.



## CONTINUE

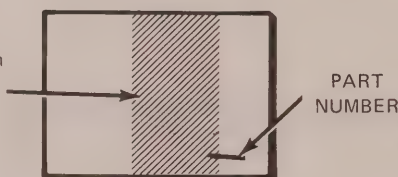
NOTE: In the following steps, solder the lugs to the foil as you install each trimmer.

- (✓) C95: 8-60 pF trimmer (#31-52).
- (✓) C99: 8-60 pF trimmer (#31-52).
- (✓) C103: 8-60 pF trimmer (#31-52).
- (✓) C106: 8-60 pF trimmer (#31-52).



PICTORIAL 2-5

The steps performed in this Pictorial are in this area of the circuit board.



# START

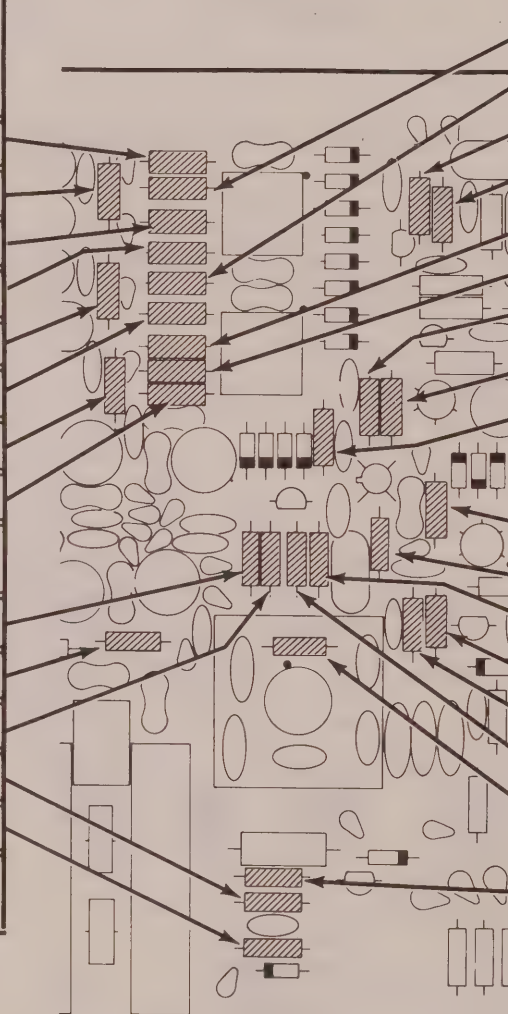
FOR GOOD SOLDER CONNECTIONS, YOU MUST **KEEP THE SOLDERING IRON TIP CLEAN.**

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



- ( ) R79: 6800  $\Omega$  (blue-gray-red).
- ( ) R81: 100 k $\Omega$  (brown-black-yellow).
- ( ) R83: 6800  $\Omega$  (blue-gray-red).
- ( ) R82: 1000  $\Omega$  (brown-black-red).
- ( ) R84: 100 k $\Omega$  (brown-black-yellow).
- ( ) R85: 1000  $\Omega$  (brown-black-red).
- ( ) R87: 100 k $\Omega$  (brown-black-yellow).
- ( ) R91: 100 k $\Omega$  (brown-black-yellow).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.
- ( ) R51: 100  $\Omega$  (brown-black-brown).
- ( ) R52: 22 k $\Omega$  (red-red-orange).
- ( ) R49: 270  $\Omega$  (red-violet-brown).
- ( ) R34: 470  $\Omega$  (yellow-violet-brown).
- ( ) R36: 1000  $\Omega$  (brown-black-red).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

## IDENTIFICATION DRAWING

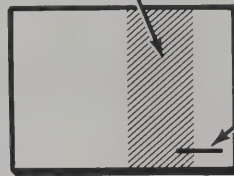


# CONTINUE

- ( ) R78: 1000  $\Omega$  (brown-black-red).
- ( ) R86: 6800  $\Omega$  (blue-gray-red).
- ( ) R92: 3300  $\Omega$  (orange-orange-red).
- ( ) R93: 470  $\Omega$  (yellow-violet-brown).
- ( ) R89: 6800  $\Omega$  (blue-gray-red).
- ( ) R88: 1000  $\Omega$  (brown-black-red).
- ( ) R44: 47 k $\Omega$  (yellow-violet-orange).
- ( ) R45: 100 k $\Omega$  (brown-black-yellow).
- ( ) R46: 100  $\Omega$  (brown-black-brown).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.
- ( ) R39: 100  $\Omega$  (brown-black-brown).
- ( ) R43: 100 k $\Omega$  (brown-black-yellow).
- ( ) R47: 47 k $\Omega$  (yellow-violet-orange).
- ( ) R38: 68 k $\Omega$  (blue-gray-orange).
- ( ) R33: 470  $\Omega$  (yellow-violet-brown).
- ( ) R48: 47 k $\Omega$  (yellow-violet-orange).
- ( ) R31: 47  $\Omega$  (yellow-violet-black).
- ( ) R32: 1 M $\Omega$  (brown-black-green).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-6

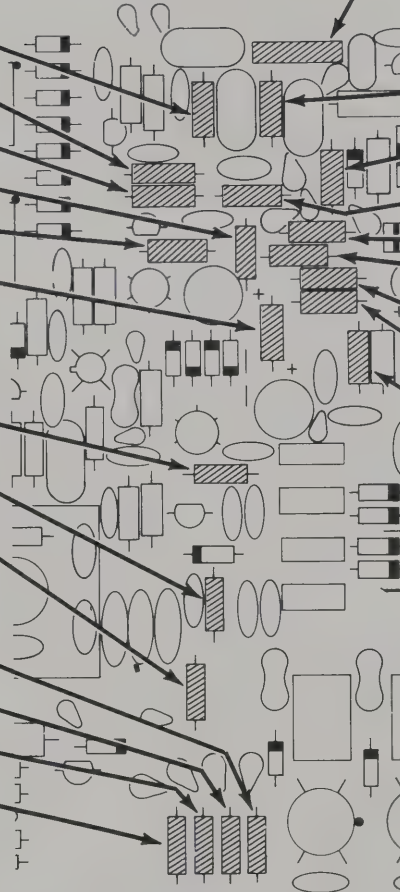
The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION  
DRAWING

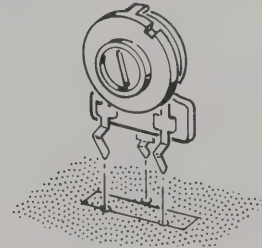
**START**

- (✓) R76: 1000  $\Omega$  (brown-black-red).
- (✓) R95: 22 k $\Omega$  (red-red-orange).
- (✓) R94: 68 k $\Omega$  (blue-gray-orange).
- (✓) R26: 2.2 M $\Omega$  (red-red-green).
- (✓) R42: 100  $\Omega$  (brown-black-brown).
- (✓) R18: 100  $\Omega$  (brown-black-brown).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) R41: 100  $\Omega$  (brown-black-brown).
- (✓) R37: 22 k $\Omega$  (red-red-orange).
- (✓) R35: 470  $\Omega$  (yellow-violet-brown).
- Install four 1000  $\Omega$  (brown-black-red) resistors.
- ( ) R1. ....
- ( ) R2. ....
- ( ) R3. ....
- ( ) R4. ....
- (✓) Solder the leads to the foil and cut off the excess lead lengths.



**CONTINUE**

- ( ) R77: 1000  $\Omega$  control (#10-936).  
Solder the lugs to the foil.

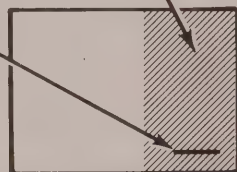


- (✓) R75: 47 k $\Omega$  (yellow-violet-orange).
- (✓) R74: 10 M $\Omega$  (brown-black-blue).
- (✓) R96: 100  $\Omega$  (brown-black-brown).
- (✓) R73: 10 M $\Omega$  (brown-black-blue).
- (✓) R28: 100  $\Omega$  (brown-black-brown).
- (✓) R17: 2700  $\Omega$  (red-violet-red).
- (✓) R16: 2700  $\Omega$  (red-violet-red).
- (✓) R11: 820  $\Omega$  (gray-red-brown).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-7

The steps performed in this Pictorial are in this area of the circuit board.

PART  
NUMBER



IDENTIFICATION  
DRAWING

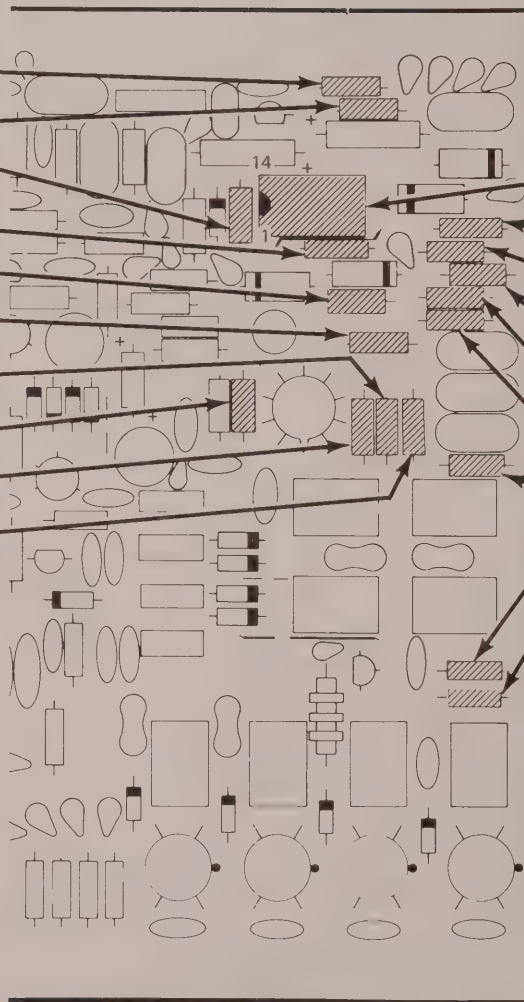
## START

FOR GOOD SOLDER CONNECTIONS, YOU MUST **KEEP THE SOLDERING IRON TIP CLEAN.**

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.

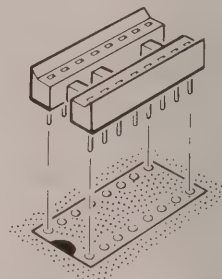


- (✓) R29: 22 k $\Omega$  (red-red-orange).
- (✓) R27: 1 M $\Omega$  (brown-black-green).
- ( ) R72: 3.3 M $\Omega$  (orange-orange-green).
- ( ) R22: 470 k $\Omega$  (yellow-violet-yellow).
- ( ) R19: 47 k $\Omega$  (yellow-violet-orange).
- ( ) R15: 10 k $\Omega$  (brown-black-orange).
- (✓) R8: 1000  $\Omega$  (brown-black-red).
- ( ) R13: 47  $\Omega$  (yellow-violet-black).
- (✓) R14: 100  $\Omega$  (brown-black-brown).
- (✓) R12: 1000  $\Omega$  (brown-black-red).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.



## CONTINUE

NOTE: To install an IC socket be sure the socket pins are straight. Then insert the socket pins and solder them to the foil.



- (✓) 14-pin IC socket at IC2.
- ( ) R25: 1 M $\Omega$  (brown-black-green).
- ( ) R23: 470 k $\Omega$  (yellow-violet-yellow).
- ( ) R24: 82 k $\Omega$  (gray-red-orange).
- (✓) R21: 82 k $\Omega$  (gray-red-orange).
- ( ) R9: 1200  $\Omega$  (brown-red-red).
- ( ) R7: 1000  $\Omega$  (brown-black-red).
- ( ) R6: 270  $\Omega$  (red-violet-brown).
- ( ) R5: 100 k $\Omega$  (brown-black-yellow).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-8

The steps performed in this Pictorial are in this area of the circuit board.



PART  
NUMBER

IDENTIFICATION  
DRAWING

## START

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



(✓) C87: 47 pF mica.

(✓) C84: 130 pF mica.

(✓) C81: 470 pF mica.

(✓) C114: 270 pF mica.

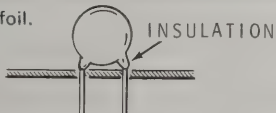
(✓) C82: 230 pF mica.

(✓) C77: 680 pF mica.

(✓) C78: 330 pF mica.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

NOTE: When you install disc capacitors, do not push the insulated portions of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.



( ) C79: .05  $\mu$ F disc.

(✓) C83: .05  $\mu$ F disc.

(✓) C85: 130 pF mica.

(✓) C86: .05  $\mu$ F disc.

(✓) C96: 150 pF mica.

(✓) C94: 270 pF mica.

(✓) C97: 680 pF mica.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

## CONTINUE

(✓) C115: .05  $\mu$ F disc.

(✓) C117: .05  $\mu$ F disc.

(✓) C89: .05  $\mu$ F disc.

( ) C119: .05  $\mu$ F disc.

(✓) C76: .05  $\mu$ F disc.

(✓) C66: 150 pF mica.

(✓) C122: .05  $\mu$ F disc.

(✓) C64: 230 pF mica.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

(✓) C67: .05  $\mu$ F disc.

(✓) C69: .05  $\mu$ F disc.

(✓) C71: 47 pF mica.

(✓) C68: 100 pF mica

(✓) C107: 100 pF mica.

(✓) C108: 150 pF mica.

(✓) C104: 75 pF mica.

(✓) C88: 47 pF mica.

(✓) C105: 200 pF mica.

(✓) C98: 100 pF mica.

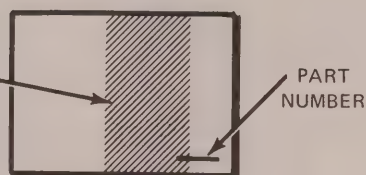
(✓) C101: 100 pF mica.

(✓) C102: 400 pF mica.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-9

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION  
DRAWING

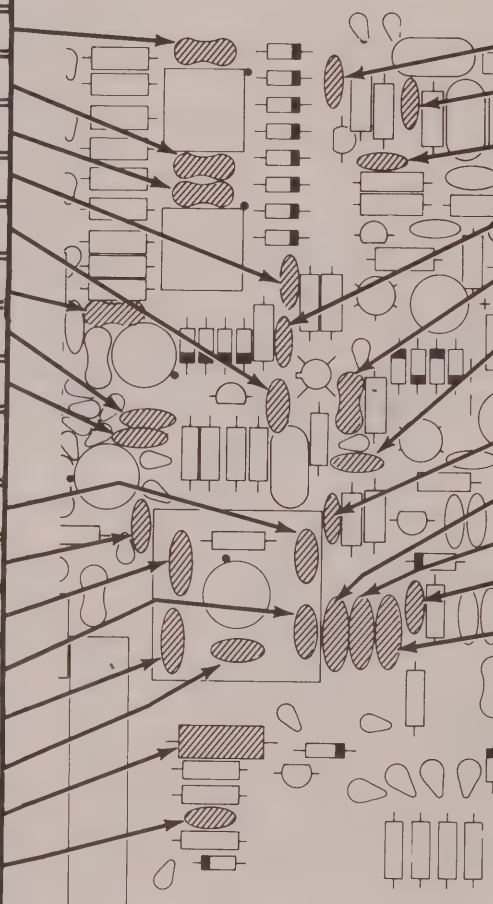
# START

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



- ( / ) C116: 100 pF mica.
- ( / ) C118: 130 pF mica.
- ( / ) C121: 47 pF mica.
- ( / ) C58: .05  $\mu$ F disc.
- ( / ) C73: 3.3 pF disc.
- ( ) C123: 24 pF mica.
- ( / ) C65: .05  $\mu$ F disc.
- ( / ) C72: .05  $\mu$ F disc.
- ( / ) Solder the leads to the foil and cut off the excess lead lengths.
- ( / ) C47: 6.8 pF disc.
- ( / ) C75: .05  $\mu$ F disc.
- ( / ) C51: 56 pF disc.
- ( / ) C54: 3.3 pF disc.
- ( ) C49: 56 pF disc.
- ( ) C48: 27 pF disc.
- ( ) C53: 4.7 pF ceramic.
- ( / ) C55: 6 pF disc.
- ( / ) Solder the leads to the foil and cut off the excess lead lengths.

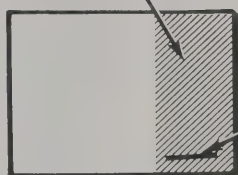


# CONTINUE

- ( / ) C125: 5 pF disc.
- ( / ) C126: 10 pF disc.
- ( / ) C127: 3.3 pF disc.
- ( / ) C63: .05  $\mu$ F disc.
- ( / ) C61: 100 pF mica.
- ( / ) C62: .05  $\mu$ F disc.
- ( / ) Solder the leads to the foil and cut off the excess lead lengths.
- ( / ) C52: .05  $\mu$ F disc.
- ( / ) C44: 510 pF disc.
- ( / ) C45: 510 pF disc.
- ( / ) C56: .05  $\mu$ F disc.
- ( / ) C46: 510 pF disc.
- ( / ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-10

The steps performed in this Pictorial are in this area of the circuit board



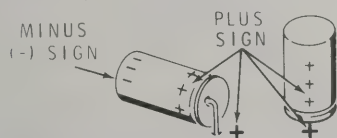
IDENTIFICATION  
DRAWING

## START

(✓) C43: .05  $\mu$ F disc.

(✓) C109: .022  $\mu$ F Mylar.

NOTE: When you install an electrolytic capacitor, always connect the lead at the positive (+) end of the capacitor to the positive (+) marked point on the circuit board. Be careful, only the negative end of the capacitor may be marked.



(✓) C42: 2  $\mu$ F electrolytic.

(✓) C38: 2  $\mu$ F electrolytic.

(✓) C128: .05  $\mu$ F disc.

(✓) C59: .05  $\mu$ F disc.

(✓) C57: .05  $\mu$ F disc.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

(✓) C23: .05  $\mu$ F disc.

(✓) C21: .05  $\mu$ F disc.

(✓) C17: .05  $\mu$ F disc.

(✓) C14: .05  $\mu$ F disc.

(✓) C1: 68 pF mica.

(✓) C4: 68 pF mica.

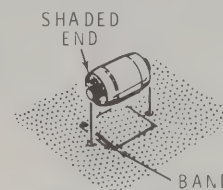
(✓) C2: .05  $\mu$ F disc.

(✓) C5: .05  $\mu$ F disc.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

## CONTINUE

NOTE: In the following four steps, be sure you position each capacitor so its shaded end is toward the banded end of the outline on the circuit board, as shown.



(✓) C36: 1000 pF polystyrene.

(✓) C37: 1000 pF polystyrene.

(✓) C34: 1800 pF polystyrene.

(✓) C35: 1800 pF polystyrene.

(✓) C29: .05  $\mu$ F disc.

(✓) C28: .05  $\mu$ F disc.

(✓) C25: 10 pF disc.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

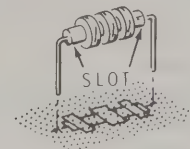
(✓) C15: 47 pF mica.

(✓) C18: 75 pF mica.

(✓) C13: .05  $\mu$ F disc.

(✓) C12: 3.3 pF disc.

(✓) RFC1: 350  $\mu$ H choke (#45-82)  
CAUTION: Bend the leads toward the slot in the core.



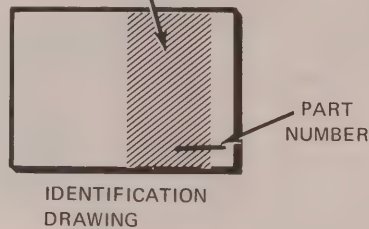
(✓) C11: .05  $\mu$ F disc.

(✓) C8: .05  $\mu$ F disc.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

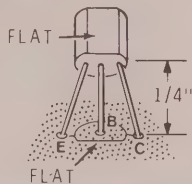
PICTORIAL 2-11

The steps performed in this Pictorial are in this area of the circuit board.



## START

NOTE: When you install a transistor, line up the flat or tab on the transistor with the outline of the flat or tab on the circuit board. Then insert the leads in the corresponding holes in the circuit board. Position it 1/4" above the circuit board; then solder the leads to the foil and cut off the excess lead lengths.



(✓) Q6: MPS-6521 transistor (#417-172).

Install two MPS-A20 transistors (#417-801).

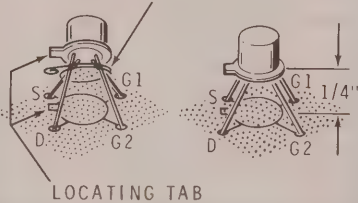
( ) Q14: . . . . .

(✓) Q7: . . . . .

(✓) Q5: MPS-A20 transistor (#417-801).

(✓) Q4: 40673 transistor (#417-240).

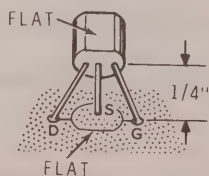
MAY OR MAY NOT  
HAVE A  
SHORTING WIRE



( ) If the transistor just installed has a shorting wire, as shown in the above drawing, remove it from the transistor leads.

(✓) Q3: MPS-A20 transistor (#417-801).

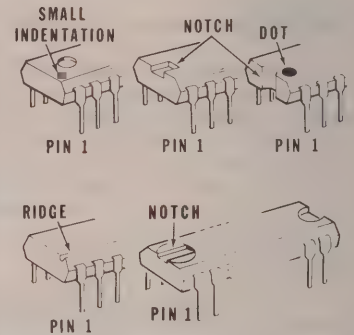
(✓) Q1: MPF-105 transistor (#417-169).



(✓) Q2: MPF-105 transistor (#417-169).

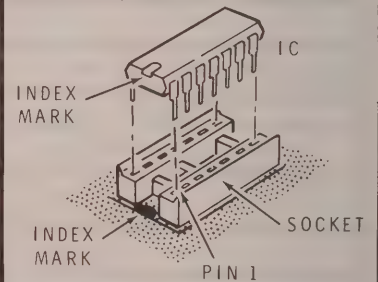
## CONTINUE

NOTE: The indexed (pin 1) end of inline integrated circuits may be marked in a number of ways such as a notch, triangle, dot, the numeral 1, etc.



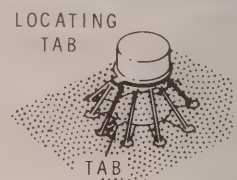
Be sure you install the IC so its indexed end is toward the index mark printed on the circuit board.

Before you apply downward pressure to an IC, make sure each IC pin is centered in its proper socket hole. Handle IC's with care as their pins are very easily bent.



(✓) IC2: LM3900 integrated circuit (#442-71).

(✓) IC1: MC1496G integrated circuit (#442-96). Line up the tab on the IC with the outline of the tab on the circuit board; then insert the leads in their respective holes, 1 through 10, on the circuit board. Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 2-12

The steps performed in this Pictorial are in this area of the circuit board.



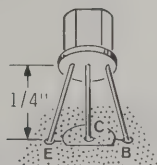
PART  
NUMBER

IDENTIFICATION  
DRAWING

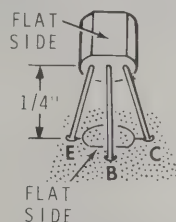
## START

(✓) Q12: MPS-A20 transistor (#417-801).

(✓) Q13: X29A829 transistor (#417-201).

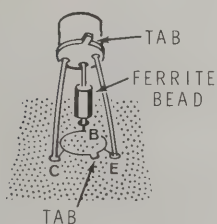


(✓) Q11: S2091 transistor (#417-116).



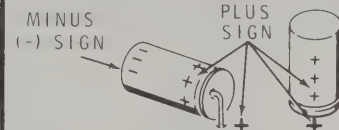
(✓) Q8: MPS6521 transistor (#417-172).

(✓) Q9: 2N4427 transistor (#417-880). Place a ferrite bead on the B (base) lead. Then mount the transistor as shown.



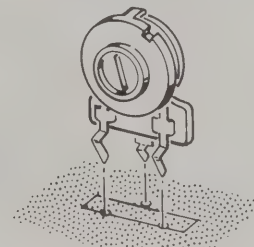
## CONTINUE

NOTE: When you install an electrolytic capacitor, always connect the lead at the positive (+) end of the capacitor to the positive (+) marked point on the circuit board. Be careful, only the negative end of the capacitor may be marked.



(✓) C92: 10  $\mu$ F electrolytic.

(✓) R68: 50 k $\Omega$  control (#10-222).

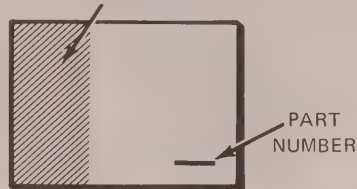


(✓) C91: 2  $\mu$ F electrolytic.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-13

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION  
DRAWING

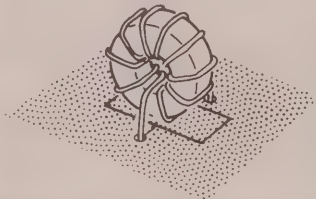
## START

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



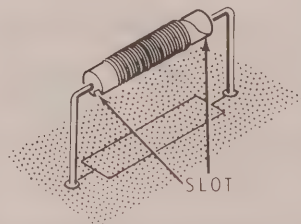
NOTE: When you install a coil in the following steps, keep it within the outline on the circuit board. Solder the leads to the foil and cut off the excess lead lengths as each coil is installed.



(✓) 9  $\mu$ H coil (#40-1797) at L22.

(✓) 4.2  $\mu$ H coil (#40-1798) at L23.

(✓) 26  $\mu$ H choke (#45-62) at RFC3. Bend the leads toward the slot as shown.



(✓) C93: .47  $\mu$ F Mylar.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

(✓) L26: 15.5  $\mu$ H coil (#40-1882).

(✓) L27: 27.5  $\mu$ H coil (#40-1791).

(✓) L29: 7  $\mu$ H coil (#40-1726).

## CONTINUE

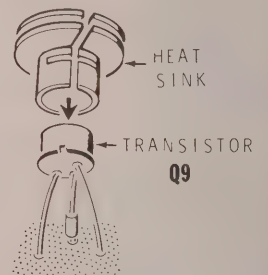
(✓) L24: 1.8  $\mu$ H coil (#40-1792).

(✓) L25: 1.3  $\mu$ H coil (#40-1800).

(✓) RFC2: 350  $\mu$ H choke (#45-82). CAUTION: Bend the leads toward the slot in the core.



(✓) Place heat sink (#215-45) on transistor Q9 as shown.



(✓) L31: 2.5  $\mu$ H coil (#40-1609).

(✓) L32: 2.5  $\mu$ H coil (#40-1609).

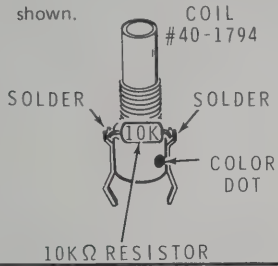
(✓) L28: 7  $\mu$ H coil (#40-1726).

PICTORIAL 2-14

**START**

(✓) Locate a 10 k $\Omega$  (brown-black-orange) resistor, and coil #40-1794.

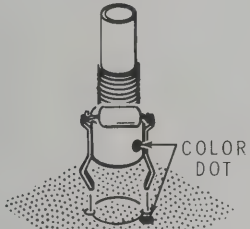
(✓) Refer to the following drawing and solder the 10 k $\Omega$  resistor between the lugs of the coil. NOTE: Be sure you mount the resistor so the color dot on the coil is positioned as shown.



**NOTES:**

1. In the following steps, be sure you position the color dot on the coil toward the dot of the coil outline on the circuit board.
2. Solder the pins to the foil as you install each part.

(✓) L13/R50: Mount the coil-resistor combination at L13.

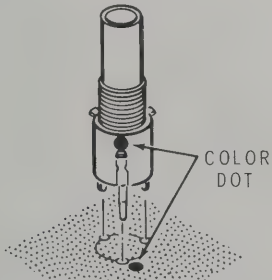


(✓) L14: 4  $\mu$ H coil (#40-1795).

(✓) L15: 1.3  $\mu$ H coil (#40-1796).

(✓) L16: 1.3  $\mu$ H coil (#40-1796).

(✓) L9: 5  $\mu$ H coil (#40-1802).

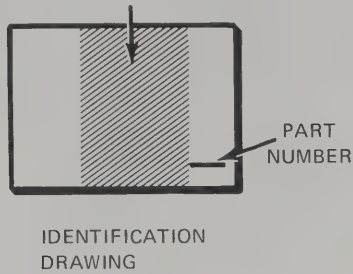


(✓) L33: 1.3  $\mu$ H toroid coil (#40-1800).

(✓) L34: 1.3  $\mu$ H toroid coil (#40-1800).

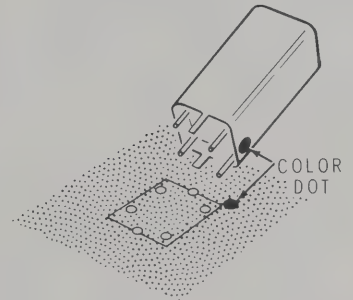
(✓) Solder the leads to the foil and cut off the excess lead lengths.

The steps performed in this Pictorial are in this area of the circuit board.



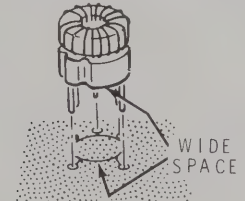
**CONTINUE**

(✓) L17/L18: 80/40 meter heterodyne oscillator coil (#40-1803).



(✓) L19/L21: 20/15 meter heterodyne oscillator coil (#40-1804).

(✓) L12: 15  $\mu$ H toroid coil (#40-1050). Match the color dot on the wide space on the circuit board.



(✓) L11: 15  $\mu$ H toroid coil (#40-1050).

(✓) Be sure the shield cans of coils L17, L18, L19, and L21 do not touch the leads of the resistors at the left side of the coils. If necessary, use a small screwdriver and very carefully press the bottom edge of each shield just far enough away from the resistor leads so they do not touch.

**PICTORIAL 2-15**

The steps performed in this Pictorial are in this area of the circuit board.

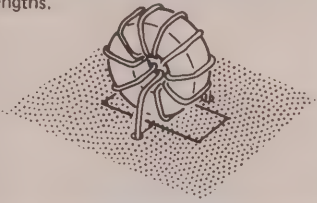
**START** →

**FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.**

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



NOTE: When you install a coil in the following steps, keep it within the coil outline on the circuit board. Solder the leads to the foil and cut off the excess lead lengths.



(✓) L8: 1.3  $\mu$ H toroid coil (#40-1800).

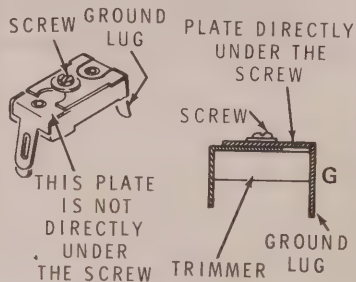
(✓) L7: 1.8  $\mu$ H toroid coil (#40-1792).

(✓) L6: 4.2  $\mu$ H toroid coil (#40-1798).

(✓) L5: 15.5  $\mu$ H toroid coil (#40-1882).

**NOTES:**

1. You will install four trimmer capacitors on the circuit board in the following steps. Note that there are two different values of trimmers.
2. Some of the trimmer lugs have two or more leaves. When you install the trimmers, make sure all of the lug leaves go through the circuit board.
3. IT IS VERY IMPORTANT to solder the correct trimmer lug to the correct foil. One lug on each trimmer will be called the ground lug (G). This is the lug that is connected to the metal plate directly under the screw on the trimmer.



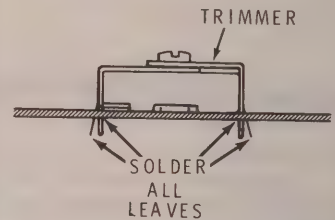
PART  
NUMBER

IDENTIFICATION  
DRAWING

**CONTINUE** →

NOTES: (cont'd.)

4. Make sure that each trimmer capacitor is properly positioned and soldered to the foil. If a trimmer lug has more than one leaf, make sure all leaves are soldered.



(✓) C3: 8-60 pF trimmer (#31-52).

(✓) C24: 8-60 pF trimmer (#31-52).

(✓) C22: 8-60 pF trimmer (#31-52).

(✓) C19: 4-40 pF trimmer (#31-54).

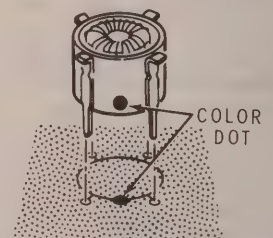
(✓) C16: 4-40 pF trimmer (#31-54).

(✓) C6: 4-40 pF trimmer (#31-54).

(✓) C7: 8-60 pF trimmer (#31-52).

(✓) C9: 8-60 pF trimmer (#31-52).

Install four toroid coils as shown below.



(✓) L4: 1.8  $\mu$ H toroid coil (#40-1788).

(✓) L3: 1.8  $\mu$ H toroid coil (#40-1788).

(✓) L2: 4.7  $\mu$ H toroid coil (#40-1787).

(✓) L1: 13  $\mu$ H toroid coil (#40-1786).

(✓) Solder the lugs to the foil.

**PICTORIAL 2-16**

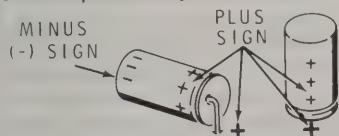
The steps performed in this Pictorial are in this area of the circuit board.

PART  
NUMBER  
  
IDENTIFICATION  
DRAWING

## START

Note the different position of the circuit board in this Pictorial.

NOTE: When you install an electrolytic capacitor, always connect the lead at the positive (+) end of the capacitor to the positive (+) marked point on the circuit board. Be careful, only the negative end of the capacitor may be marked.



(✓) C41: 100  $\mu$ F electrolytic.

(✓) C32: 100  $\mu$ F electrolytic.

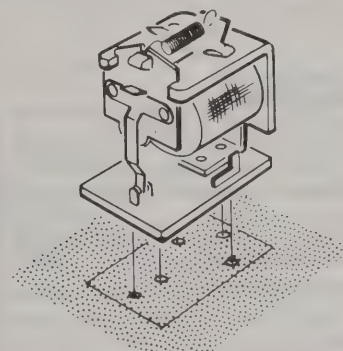
(✓) C33: 10  $\mu$ F electrolytic.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

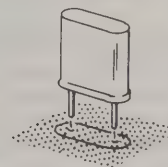
## CONTINUE

NOTE: In the following five steps, solder the pins to the foil as you install each part.

(✓) RY1: Relay (#69-47). CAUTION: Do not bend any of the mechanical parts on the relay.



(✓) Y1: 12.395 MHz crystal (#404-207).



(✓) Y2: 15.895 MHz crystal (#404-208).

(✓) Y3: 22.895 MHz crystal (#404-209).

(✓) Y4: 29.895 MHz crystal (#404-210).

Install eight .1  $\mu$ F Mylar capacitors.

(✓) C74.

(✓) C112.

(✓) C111.

(✓) C113.

(✓) C27.

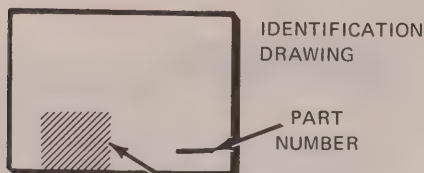
(✓) C26.

(✓) C31.

(✓) C39.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-17



The steps performed in this Pictorial are in this area of the circuit board.

### START

**FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.**

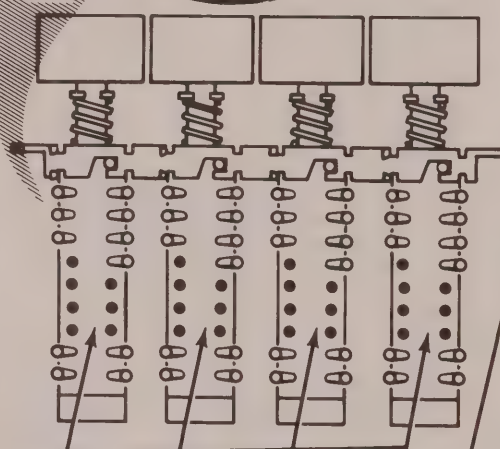
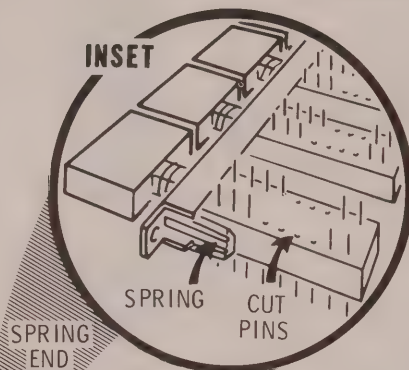
WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



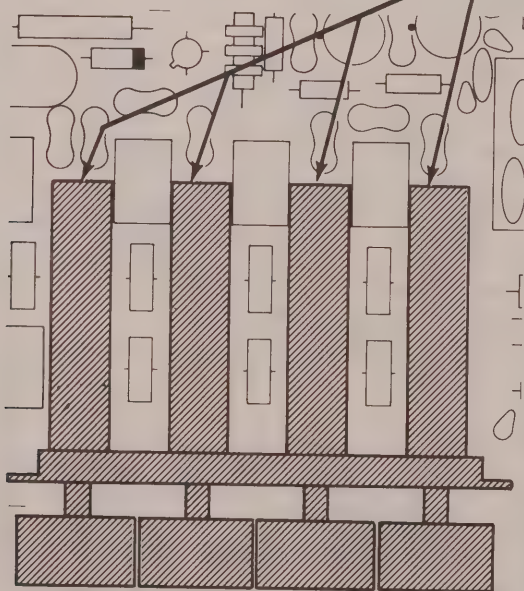
**NOTE:** There is a spring at one end of the pushbutton switch assembly. (See inset drawing.) When you perform the next two steps, be sure you position the switch assembly so its spring end is toward your left as shown.

(✓) Position the pushbutton switch assembly so its spring end is toward your left as shown in Detail 2-18A.

(✓) Very carefully cut the indicated pins off each of the four switches. Cut them as close as possible to the body of each switch.



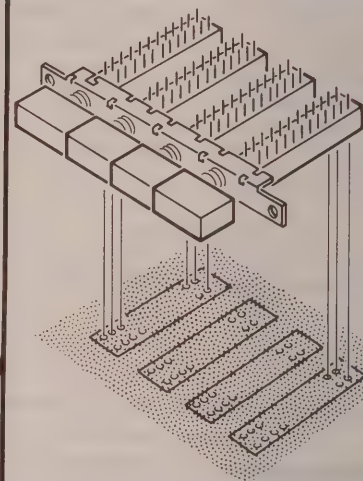
DETAIL 2-18A



PICTORIAL 2-18

### CONTINUE

( ) Turn the switch assembly over and line up the remaining pins with their respective holes in the circuit board.



(✓) Start the pins into the circuit board holes. Then press the switch assembly tight against the circuit board. Also, make sure the assembly is parallel with the circuit board. Then turn the assembly over and solder two lugs on each end of the switch assembly. Check the switch assembly to make sure it is straight. If the assembly is straight, solder the other switch lugs. Cut off the excess lugs from the foil side of the board.

### CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

- ( ) Unsoldered connections.
- ( ) "Cold" solder connections.
- ( ) Solder bridges between foil patterns.
- ( ) Protruding leads which could touch together.
- ( ) Transistors for the proper type and installation.
- ( ) Electrolytic capacitors for the correct position of the positive (+) end.
- ( ) Diodes for the correct position of the banded end.

### FINISH

## CIRCUIT BOARD WIRING

### NOTES:

1. In the following steps, you will use the 5-wire cable supplied with the kit to prepare four multiwire cables. Each cable will be connected to the circuit board as soon as it is prepared.

**CAUTION:** When you prepare a multiwire cable in the following steps, grip the cable securely when you remove insulation from one of the wires. This will prevent you from pulling one of the wires out of the cable.

2. When you prepare the ends of the cable wires, cut each wire to the length indicated in the appropriate Detail and remove 1/4" of insulation from each end of each wire. Then twist the strands and apply a small amount of solder to the wire ends to hold the strands together.
3. Solder each wire to the foil as it is connected to the circuit board. Then cut off the excess wire lengths.

Refer to Pictorial 3-1 in the Illustration Booklet for the following steps.

- ( ) Refer to Detail 3-1A and prepare an 8" cable as shown.

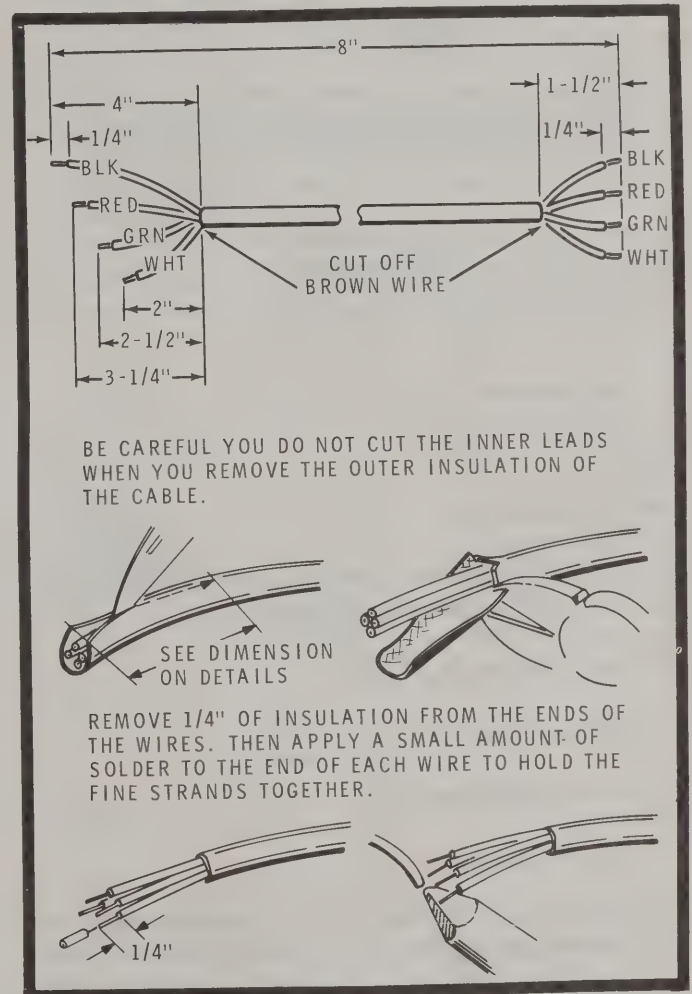
Connect the wires at the shorter prepared end of this cable to the following circuit board holes.

- (✓) White to hole NN.
- (✓) Green to hole MM.
- (✓) Red to hole LL.
- (✓) Black to hole KK.

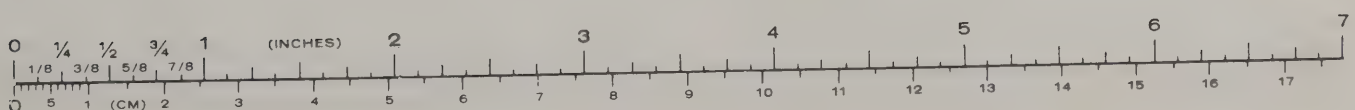
**NOTE:** In the following steps, (NS) means not to solder because another wire (or wires) will be added later. The letter S with a number, such as (S-2), means to solder the connection. The number that follows the letter S indicates the number of wires at that connection.

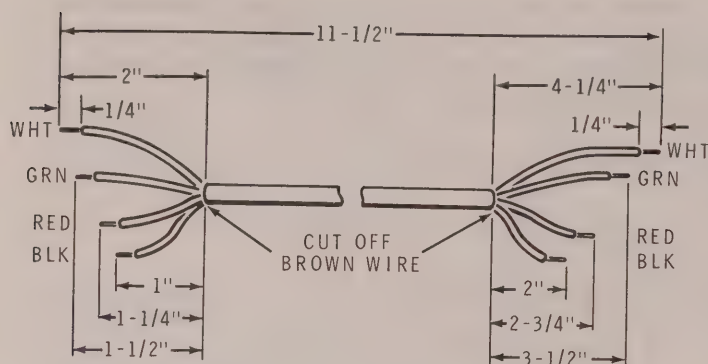
Connect the wires at the free end of the 8" cable to the pushbutton switch assembly as follows. Wrap each wire around the pin so it makes a secure mechanical connection before you solder the wire to the pin.

- ( ) White to switch SW4 pin 9 (NS).
- ( ) Green to switch SW3 pin 9 (NS).
- ( ) Red to switch SW2 pin 9 (NS).
- ( ) Black to switch SW1 pin 9 (NS).



Detail 3-1A





Detail 3-1B

- ( ) Refer to Detail 3-1B and prepare an 11-1/2" cable as shown.

Connect the wires at the shorter prepared end of the cable to the following circuit board holes.

- (✓) Black to hole N.
- (✓) Red to hole P.
- (✓) Green to hole Q.
- (✓) White to hole R.

At the other end of the cable, connect the wires to the pushbutton switch assembly as follows:

- (✓) Black to SW1 pin 5 (S-1).
- (✓) Red to SW2 pin 5 (S-1).
- (✓) Green to SW3 pin 5 (S-1).
- (✓) White to SW4 pin 5 (S-1).
- (✓) Cut an 8-1/2" length off the remaining length of 5-wire cable. Then carefully remove all of the outer insulation from the 8-1/2" length. These cable wires will be used in the following steps.

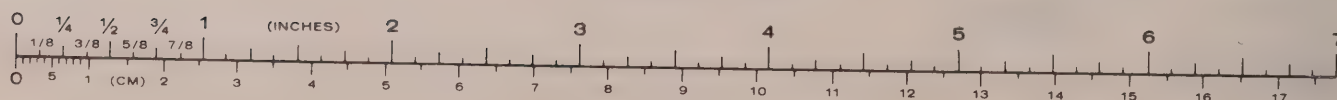
**NOTE:** When you prepare a stranded wire, cut it to the length specified in the step and remove 1/4" of insulation from each end. Then twist the strands and apply a small amount of solder to the wire ends to hold the strands together.

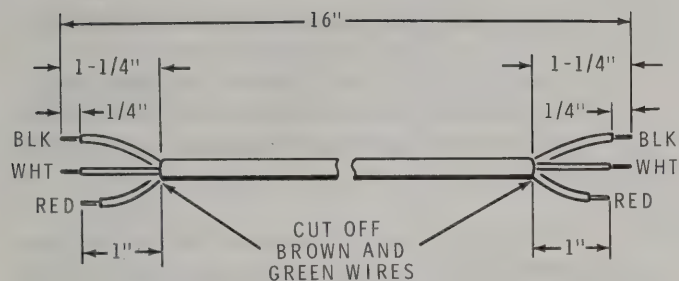
You may prefer to prepare wires ahead of time, as in the following step. The wires are listed in the order in which they are used. Save the remaining wires for use later.

- (✓) Prepare the following wires:

2-1/2" white ✓	3-1/2" red ✓
2-1/2" white ✓	5" black ✓
2-1/2" green ✓	2-3/4" green ✓

- (✓) Connect a 2-1/2" white wire between circuit board holes 4 (S-1) and 4 (S-1).
- (✓) Connect a 2-1/2" white wire from switch SW4 pin 9 (S-2) to circuit board hole 8 (S-1).
- (✓) Connect a 2-1/2" green wire from switch SW3 pin 9 (S-2) to circuit board hole 7 (S-1).
- (✓) Connect a 3-1/2" red wire from switch SW2 pin 9 (S-2) to circuit board hole 6 (S-1).
- (✓) Connect a 5" black wire from switch SW1 pin 9 (S-2) to circuit board hole 5 (S-1).
- (✓) Connect a 2-3/4" green wire between circuit board holes 3 (S-1) and 3 (S-1).
- (✓) Position the cable wires connected to the pushbutton switch assembly down between the switch pins and against the body of the switches. Position the circuit board wires as shown on the Pictorial.





**Detail 3-1C**

(✓) Refer to Detail 3-1C and prepare a 16" cable. At one end of the cable, connect the wires to the following circuit board holes.

(✓) Red to hole HH.

(✓) Black to hole JJ.

(✓) White to hole EE.

The other end of the cable will be connected later.

(✓) Refer to Detail 3-1D and prepare an 11" cable.

At the longer prepared end, connect the wires to the following circuit board holes.

(✓) White to hole PP.

(✓) Black to hole CC.

The green wire, and the wires at the other end of the cable, will be connected later.

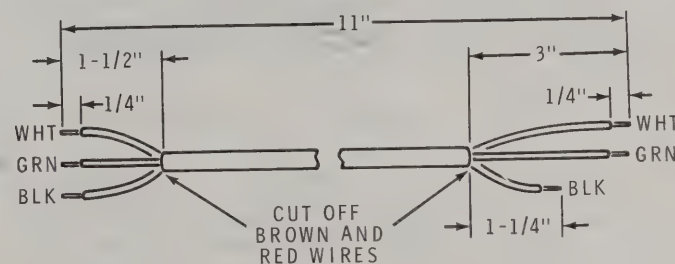
#### NOTES:

1. When the hardware is called for in a step, only the screw size will be given. For instance, if 6-32 x 1/4" hardware is called for, it means to use a 6-32 x 1/4" screw, one or more #6 lockwashers, and a 6-32 nut. The Detail, inset drawing, or Pictorial referred to in the steps will show the proper number of lockwashers and the type of screw to use.

2. Use the plastic nut starter supplied with the kit to hold and start 6-32 and 4-40 nuts on screws.

(✓) Refer to the inset drawing on Pictorial 3-1 and mount an angle bracket (#204-1844) on the upper edge of the circuit board. Use 6-32 x 1/4" hardware at the three locations shown. Tighten the hardware only finger tight.

(✓) Move the angle bracket as far as it will go away from the edge of the circuit board. Then tighten the screws.



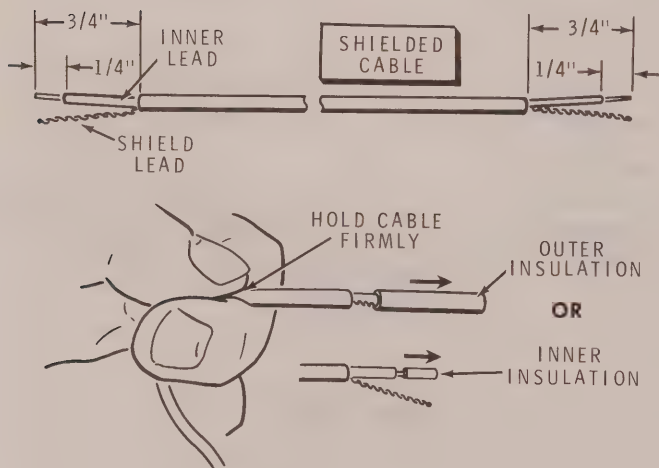
**Detail 3-1D**

Refer to Pictorial 3-2 in the Illustration Booklet for the following steps.

- ( ) Connect a 2-1/2" red wire between circuit board holes 2 (S-1) and 2 (S-1).
- ( ) Connect a 3-1/2" black wire between circuit board holes 1 (S-1) and 1 (S-1).

#### NOTES:

1. All of the shielded cables used in this kit will have their ends prepared and dimensioned as specified in Detail 3-2A. CAUTION: Hold each cable as shown when you prepare its ends. This will prevent you from pulling the inner lead out of the cable when you remove outer or inner insulation.
2. The step that directs you to prepare a shielded cable will specify its length.



Detail 3-2A

- (✓) Refer to Detail 3-2A and prepare a 4" shielded cable.

- ( ) At one end of this cable, connect the shield lead to hole S (S-1) and the inner lead to hole C (S-1). NOTE: These two holes are near the center of the circuit board.

- (✓) At the other end of the cable, carefully cut off only the shield lead. Then connect the inner lead to hole H (S-1).

- (✓) Refer to Detail 3-2A and prepare four 7" shielded cables.

- (✓) At one end of a 7" shielded cable, wrap the inner lead around SW1 pin 3 (S-1) and the shield lead around pin 4 (S-1).

NOTE: Be very careful when you connect the shielded cables in the following steps. Do not allow the shield wires to touch adjacent coil or switch lugs. Position the leads down between the coils; then carefully wrap the leads around the coil lugs. Solder the leads to the lugs and cut off the excess lead lengths. CAUTION: Use only enough heat and solder to make a good connection.

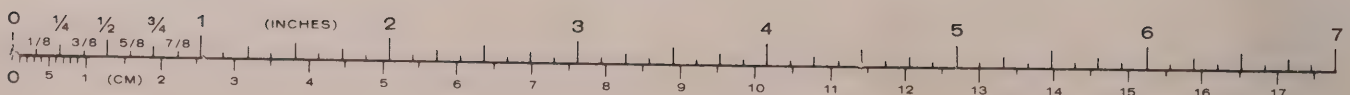
- (✓) At the free end of the 7" cable, wrap the shield lead around coil L1 lug 2 (S-1) and the inner lead around lug 1 (S-1).

- (✓) At one end of another 7" cable, wrap the inner lead around SW2 pin 3 (S-1) and the shield lead around pin 4 (S-1).

- (✓) At the other end of the cable, wrap the shield lead around coil L2 lug 2 (S-1) and the inner lead around lug 1 (S-1).

- (✓) At one end of another 7" cable, wrap the inner lead around SW3 pin 3 (S-1) and the shield lead around pin 4 (S-1).

- (✓) At the other end of the cable, wrap the shield lead around coil L3 lug 2 (S-1) and the inner lead around lug 1 (S-1).



- (✓) At one end of another 7" cable, wrap the inner lead around SW4 pin 3 (S-1) and the shield lead around pin 4 (NS).
- (✓) At the other end of the cable, wrap the shield lead around L4 lug 2 (S-1) and the inner lead around lug 1 (S-1).
- (✓) Refer to Detail 3-2A and prepare a 5-1/2" shielded cable.
- (✓) At one end of the cable, wrap the inner lead around SW4 pin 2 (NS) and the shield lead around lug 4 (S-2). The other end of this cable will be connected later.
- (✓) Refer to Detail 3-2A and prepare a 13-1/2" shielded cable.
- (✓) At one end of this cable, connect the shield lead to the indicated circuit board hole S (S-1) and the inner lead to hole M (S-1). The other end of this cable will be connected later.
- (✓) Refer to Detail 3-2A and prepare a 7" shielded cable.
- (✓) At one end of this cable, connect the shield lead to the other circuit board hole marked S (S-1) and the inner lead to hole L (S-1). The other end of this cable will be connected later.

Refer to Pictorial 3-3 in the Illustration Booklet for the following steps.

#### NOTES:

1. Use yellow hookup wire when you perform the following steps. After you connect a wire on the circuit board, solder the wire to the foil and cut off the excess wire lengths.
2. When you connect a wire to one of the pins of the pushbutton switch assembly, wrap the wire around the pin so it makes a secure mechanical connection before you apply any solder.

- (✓) Prepare the following wires:

8-1/2"	10"
6-1/2"	8"
1-1/2"	4"
3-1/2"	2-1/2"

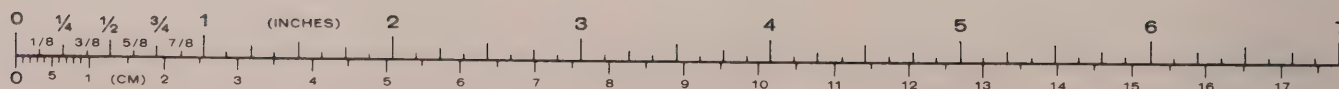
- (✓) Connect an 8-1/2" wire between circuit board holes J (S-1) and WW (S-1).
- (✓) Connect a 6-1/2" wire between circuit board holes V (S-1) and V (S-1).
- (✓) Install a 1-1/2" wire at the location marked JUMPER. NOTE: Position this wire over R22, the 470 kΩ (yellow-violet-yellow) resistor, as shown.
- (✓) Connect a 3-1/2" wire between circuit board holes U (S-1) and U (S-1).
- (✓) Connect a 10" wire between circuit board holes K (S-1) and B (S-1).
- (✓) Connect an 8" wire from circuit board hole XX (S-1) to switch SW1 pin 6 (NS).
- (✓) Connect a 4" wire from circuit board hole D (S-1) to switch SW4 pin 8 (NS).
- (✓) Connect a 2-1/2" wire from circuit board hole T (S-1) to SW4 pin 6 (NS).
- ( ) Prepare the following yellow wires:

2"	2-1/2"	2"
2"	2-1/2"	2"
2"	2-1/2"	2"

Connect wires between the pins of the pushbutton switch assembly as follows:

- (✓) 2" yellow from SW1 pin 8 (S-1) to SW2 pin 8 (NS).
- (✓) 2" yellow from SW2 pin 8 (S-2) to SW3 pin 8 (NS).
- (✓) 2" yellow from SW3 pin 8 (S-2) to SW4 pin 8 (S-2).
- (✓) 2-1/2" yellow from SW1 pin 6 (S-2) to SW2 pin 6 (NS).
- (✓) 2-1/2" yellow from SW2 pin 6 (S-2) to SW3 pin 6 (NS).
- (✓) 2-1/2" yellow from SW3 pin 6 (S-2) to SW4 pin 6 (S-2).

- (✓) 2" yellow from SW4 pin 2 (S-2) to SW3 pin 2 (NS).
  - (✓) 2" yellow from SW3 pin 2 (S-2) to SW2 pin 2 (NS).
  - (✓) 2" yellow from SW2 pin 2 (S-2) to SW1 pin 2 (S-1).
  - (✓) Group together all of the wires and cables at D on the Pictorial. Then refer to the inset drawing and, using a cable tie as shown, tie all of the wires and cables tightly together.
  - (✓) In a similar manner, use cable ties to securely tie together the wires and/or cables at E and F.
  - (✓) Position the wires on the circuit board as shown in the Pictorial.
- This completes the circuit board wiring. Shake out any loose wire clippings or solder splashes. Recheck the circuit board for any solder bridges between adjacent foil patterns. Then set the circuit board aside until it is called for later.



# CHASSIS

## PARTS LIST

Check the remaining parts against the following list. Make a check (✓) in the space provided as you identify each part. The illustrations show what the part looks like. Only the hardware is shown actual size.

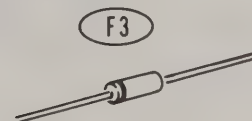
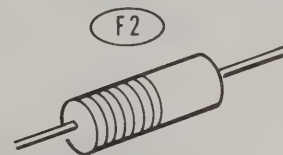
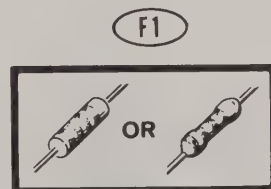
Some parts are packaged in containers with the part number marked on the outside. Except for the initial parts check, keep these parts in their containers so they can be easily identified when they are called for in the assembly steps.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with the kit. If one is not available, see "Replacement Parts" inside the rear cover of this Manual. Your Warranty is located inside the front cover. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

### RESISTORS-DIODES

F1	(✓)	2	1000 (brown-black-red) resistor.	6-102	R303, R304
F1	(✓)	1	47 k $\Omega$ (yellow-violet-orange) resistor.	6-473	R305
F2	(✓)	2	100 $\Omega$ , 2-watt (brown-black-brown) resistor	1-20-2	R306, R307
F3	(✓)	1	1N458 diode	56-24	D301

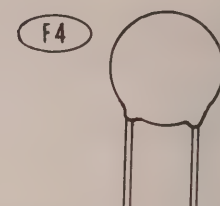


KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
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## CAPACITORS

F4 (✓)	1	.05 $\mu$ F disc capacitor	21-143
F5 (✓)	1	.47 $\mu$ F Mylar capacitor	27-86
F6 (✓)	1	Preselector tuning capacitor	26-151
F7 (✓)	1	VFO tuning capacitor	26-152
F8 (✓)	1	Loading capacitor	26-154

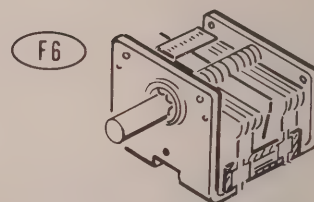
C304  
C305  
C301A/B  
  
C302A/B  
C303



## CONTROL-SWITCH

F9 (✓)	1	10 k $\Omega$ /1000 $\Omega$ control with switch	14-17
F10 (✓)	1	Rotary switch	63-3

R301, R302, S301  
  
SW302

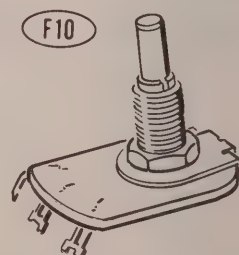
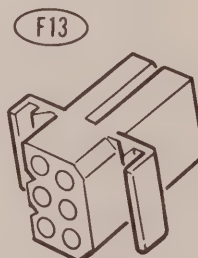
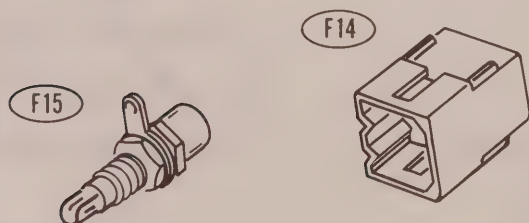
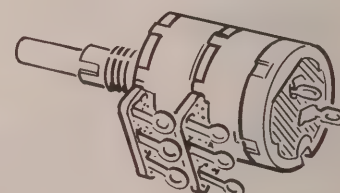
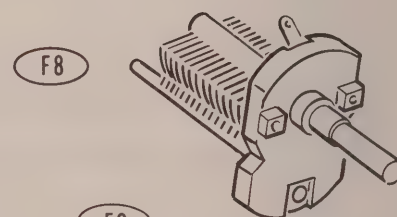
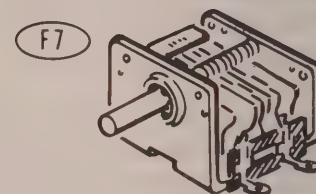


## CONNECTOR-PIN-JACK-PLUG

F11 (✓)	2	Male connector pin	432-72
F12 (✓)	2	Female connector pin	432-73
F13 (✓)	1	Chassis connector	432-94
F14 (✓)	1	Cable connector	432-95
F15 (✓)	1	Antenna socket	434-107
F16 (✓)	2	Antenna plug	438-4
F17 (✓)	2	Jack	436-20

J302

J301, J303



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
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## HARDWARE

NOTE: The hardware may be in more than one packet. Open all the hardware packets before you check the hardware against the Parts List.

### # 4 Hardware

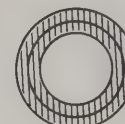
G1	( )	2	4-40 x 1/4" screw	250-52
G2	( )	2	4-40 x 1/2" flat head screw	250-322
G3	( )	2	4-40 nut	252-15
G4	( )	4	#4 lockwasher	254-9

### # 6 Hardware

G5	( )	1	6-32 x 1/8" round head screw	250-208
G6	(✓)	4	6-32 x 1/8" setscrew	250-33
G7	(✓)	6	6-32 x 3/16" screw	250-138
G8	(✓)	4	6-32 x 1/4" screw	250-56
G9	( )	4	6-32 x 1/4" flat head screw	250-416
G10	(✓)	2	6-32 x 3/8" screw	250-89
G11	( )	15	#6 x 1/4" sheet metal screw	250-170
G12	(✓)	11	6-32 nut	252-3
G13	(✓)	16	#6 lockwasher	254-1
G14	( )	2	3/16" spacer	255-2
G15	(✓)	4	#6 solder lug	259-1

### Other Hardware

G16	( )	6	Control nut	252-7
G17	(✓)	4	Control flat washer	253-10
G18	( )	2	Fiber shoulder washer	253-16
G19	( )	3	Control lockwasher	254-5
G20	( )	1	Split bushing	455-11
G21	( )	1	8-32 x 3/8" setscrew	250-1193



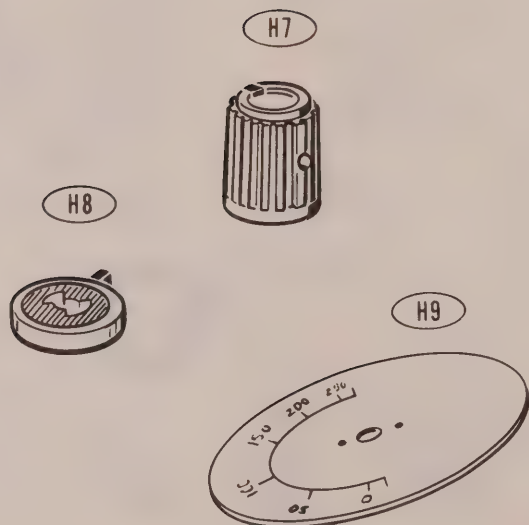
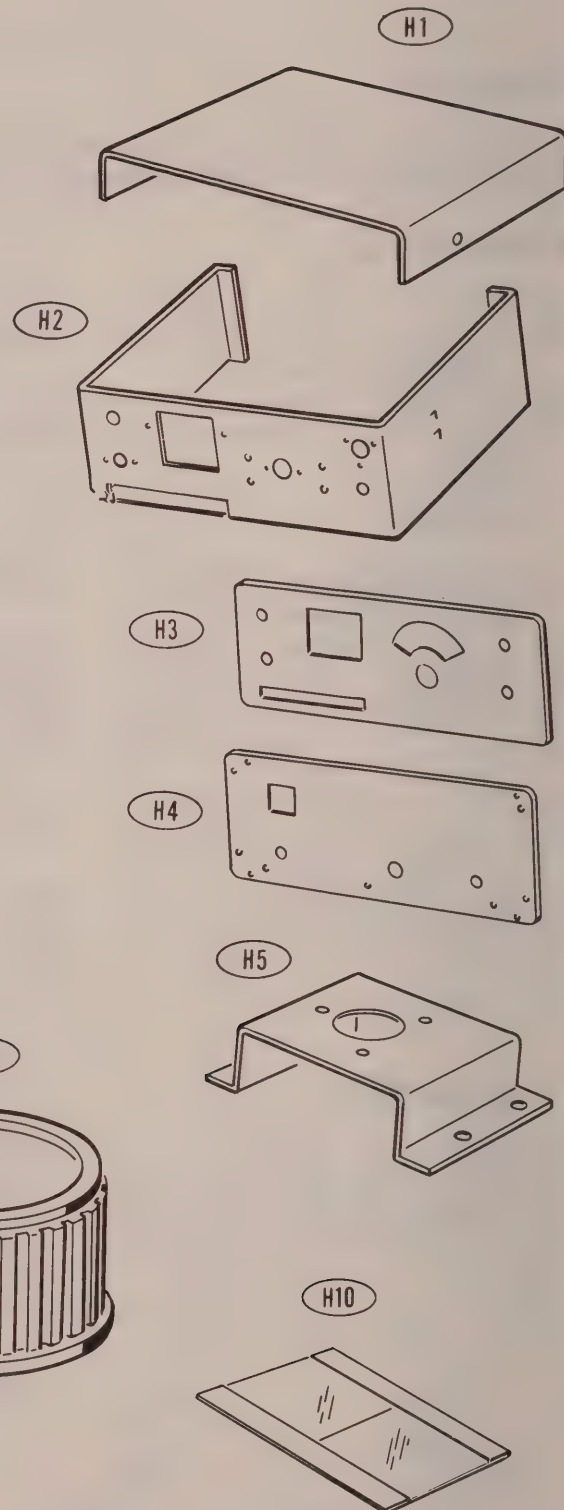
KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

## METAL PARTS

H1	(✓)	2	Cabinet shell	90-566-2
H2	(✓)	1	Chassis	200-1229
H3	(✓)	1	Front panel	203-1665-1
H4	(✓)	1	Rear panel	203-1710-2
H5	(✓)	1	Capacitor mounting bracket	204-1845

## KNOBS-DIAL-WINDOW

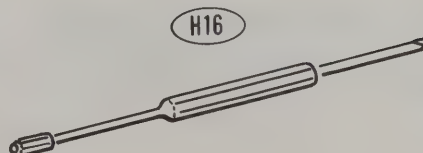
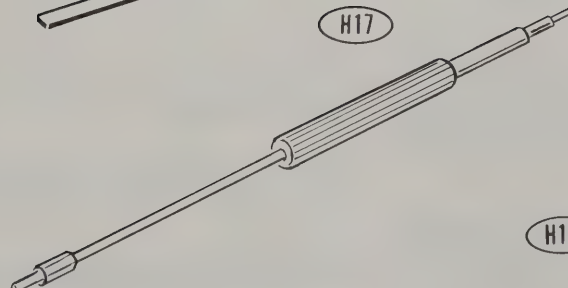
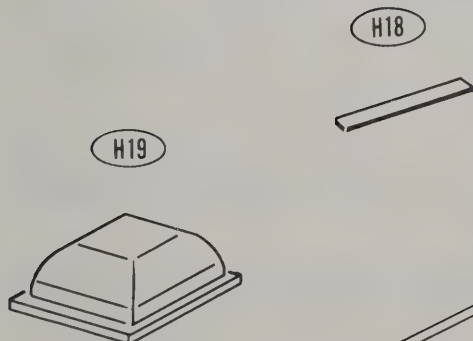
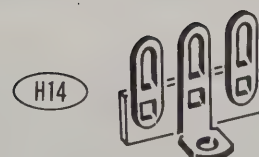
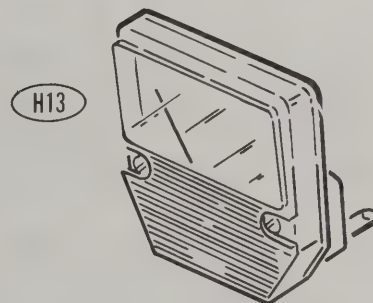
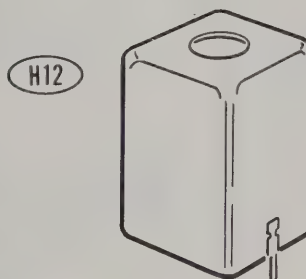
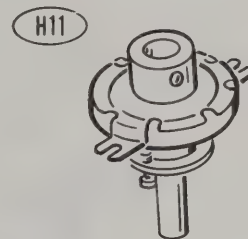
H6	(✓)	1	Large knob	462-257
H7	(✓)	4	Small knob	462-258
H8	(✓)	1	Silver knob	462-293
H9	(✓)	1	Dial	464-65-2
H10	(✓)	1	Window	446-602-1



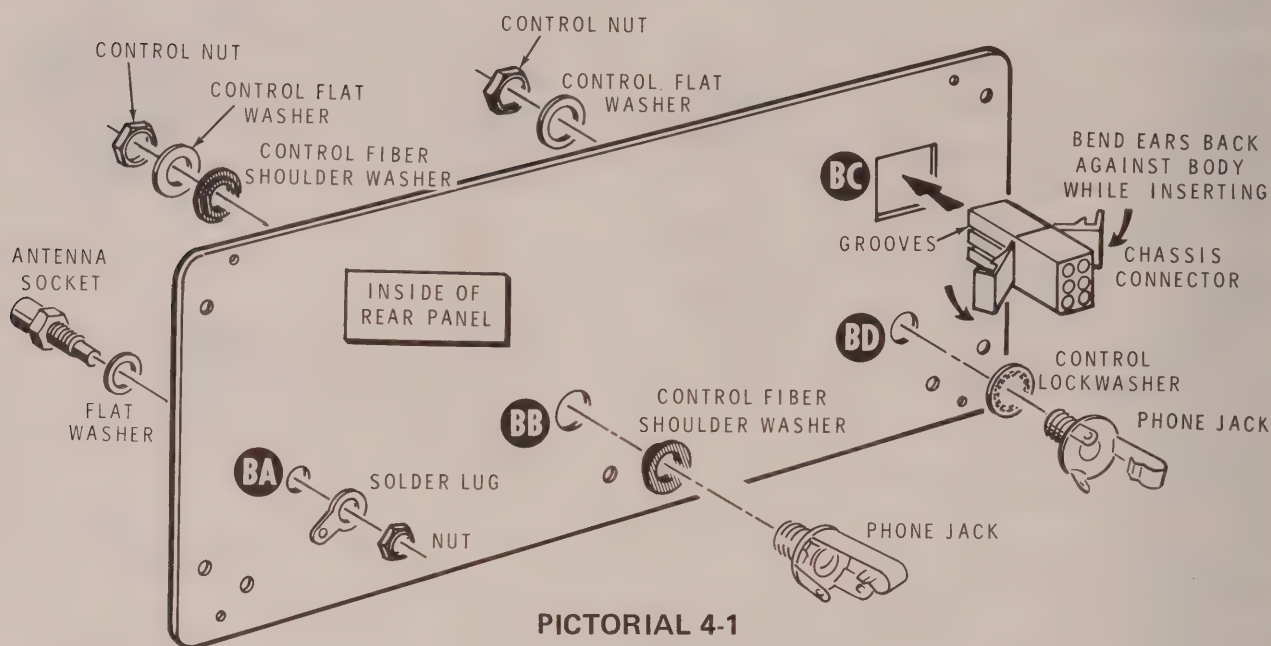
KEY	QTY.	DESCRIPTION	PART	CIRCUIT
No.			No.	Component No.

# MISCELLANEOUS

H11	(✓)	1	Vernier drive	100-1608
H12	(✓)	1	Coil shield	206-502
H13	(✓)	1	Meter	407-167
H14	(✓)	1	3-lug terminal strip	431-10
H15	(✓)	4	Plastic chassis nut	75-61
H16	(✓)	1	Alignment tool, small	490-109
H17	(✓)	1	Alignment tool, large	490-1
H18	(✓)	1	Metal blade	205-778
H19	(✓)	4	Plastic foot	261-34
	(✓)	5'	Red wire	344-3
	(✓)	5'	Black wire	344-2



## STEP-BY-STEP ASSEMBLY



PICTORIAL 4-1

### REAR PANEL PARTS MOUNTING

Refer to Pictorial 4-1 for the following steps.

- (✓) Install an antenna socket in hole BA with the hardware supplied with the socket. Position the lug as shown; then bend it away from the panel. **CAUTION:** Do not overtighten the hardware, as you could break the socket.
- (✓) Install a phone jack in hole BB with two fiber shoulder washers, a control flat washer, and a control nut. Position the jack as shown in the Pictorial. **CAUTION:** Be sure the shoulders of the fiber washers are properly seated in the panel before you tighten the hardware.
- (✓) Install a phone jack in hole BD with a control lockwasher, control flat washer, and control nut. Position the jack as shown in the Pictorial. Also, note the difference in position between this jack and jack BB.
- (✓) Install the chassis connector in hole BC. **CAUTION:** Be sure you install it so its grooves are positioned as shown in the Pictorial.

### MOUNTING AND WIRING REAR PANEL

Refer to Pictorial 4-2 in the Illustration Booklet for the following steps.

- (✓) Mount the rear panel assembly to the angle bracket on the circuit board with #6 x 1/4" sheet metal screws at the three indicated locations.

- (✓) Prepare the following yellow wires:

1-1/2"	4"
1-1/4"	4"
3-1/2"	3-1/2"
7"	2"

Connect wires from the circuit board to the parts on the rear panel as follows:

- (✓) 1-1/2" yellow wire from hole X (S-1) to socket BA lug 1 (S-1).
- (✓) 1-1/4" yellow wire from relay RY1 lug 2 (S-1) to socket BA lug 2 (S-1).

## NOTES:

1. If you use a keyer such as the Heathkit Model HD-1410, wire jack BB as directed in steps 1, 2, and 3, as shown in inset drawing #1 on Pictorial 4-2. Then disregard steps 4, 5, and 6.
  2. If you intend to use a Heathkit Model HD-10 Keyer, disregard steps 1, 2, and 3. Then wire jack BB as directed in steps 4, 5, and 6, and as shown in inset drawing #2 on Pictorial 4-2.
  3. You can use a "straight" key with both wiring options.
- (✓) 1. 3-1/2" yellow wire from hole W (S-1) to jack BB lug 2 (NS).
  - (✓) 2. 7" yellow wire from hole AA (S-1) to jack BB lug 2 (S-2).
  - (✓) 3. 4" yellow wire from hole Y (S-1) to jack BB lug 1 (S-1).
- OR —
- (✓) 4. 3-1/2" yellow wire from hole W (S-1) to jack BB lug 1 (NS).
  - (✓) 5. 7" yellow wire from hole AA (S-1) to jack BB lug 1 (S-2).
  - (✓) 6. 4" yellow wire from hole Y (S-1) to jack BB lug 2 (S-1).
- (✓) Refer to the inset drawing on Pictorial 4-2 and install a female connector pin (#432-73) on one end of a 4" yellow wire.
  - (✓) Insert the connector pin into chassis connector BC hole 3. Push in on the pin until it locks in place in the chassis connector.
  - (✓) Connect the free end of the 4" yellow wire to circuit board hole Z (S-1).
  - (✓) Connect a 3-1/2" yellow wire from circuit board hole BB (S-1) to jack BD lug 2 (NS).
  - (✓) Connect a 2" yellow wire from hole DD (S-1) to jack BD lug 1 (NS).

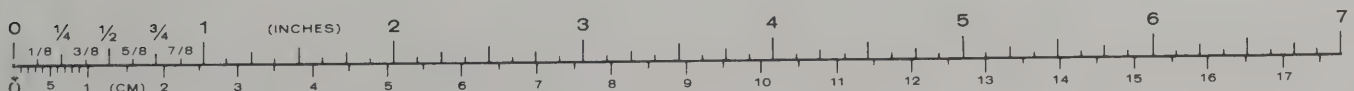
## MOUNTING PANEL/CIRCUIT BOARD ASSEMBLY

Refer to Pictorial 4-3 in the Illustration Booklet for the following steps.

- (✓) Refer to inset #1 on the Pictorial and press plastic chassis nuts into both holes at CA in the right side of the chassis.
- (✓) In the same manner, press plastic chassis nuts into both holes at DA in the other side of the chassis.
- (✓) Install 6-32 x 3/8" hardware into chassis holes AB and AD in the front of the chassis.

**CAUTION:** When you perform the following steps, be sure you position the front edge of the circuit board **ABOVE** the flange on the front of the chassis as shown in the inset drawing on the Pictorial.

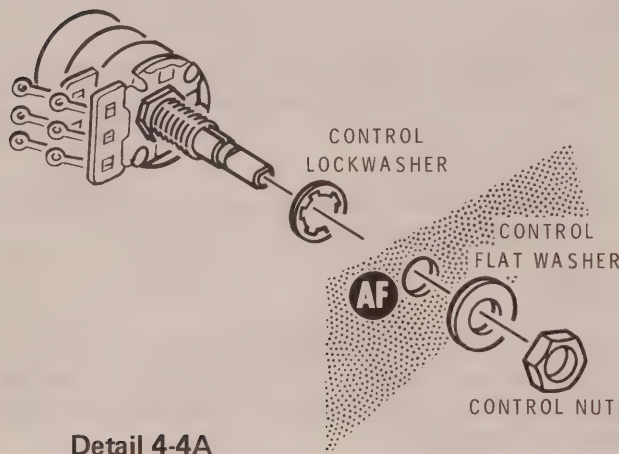
- (✓) Spring the chassis sides outward slightly; then install the panel/circuit board assembly inside the chassis. Be careful you do not pinch any wires when you insert the knobs of the pushbutton switch assembly through the opening in the front of the chassis.
- (✓) Check the operation of each pushbutton switch. Reposition any wires that interfere with proper operation.
- (✓) Be sure the front edge of the circuit board is above the chassis flange; then loosely secure the rear panel to the chassis with #6 x 1/4" sheet metal screws at the four indicated locations.
- (✓) Carefully push the cables and wires away from the front of the chassis so the mounting holes in the front edge of the circuit board are exposed.
- (✓) Secure the front edge of the circuit board to the flange with 6-32 x 1/4" hardware. Then tighten the four screws in the rear panel.



## CHASSIS PARTS MOUNTING AND WIRING

Refer to Pictorial 4-4 in the Illustration Booklet for the following steps.

- (✓) R301, R302, SW301: Refer to Detail 4-4A and install a control-with-switch (#14-17) at AF. Position the control as shown in the Pictorial.



NOTE: Inset drawing #1 on Pictorial 4-4 is a "blow-up" of the wiring of control AF. Refer to both inset drawing #1 and Pictorial 4-4 when you perform the following ten steps.

Connect the black, green, and white wires of the cable marked X on the Pictorial to control AF as follows:

1. (✓) White to lug 6 (S-1).
2. (✓) Green to lug 5 (S-1).
3. (✓) Black to lug 4 (NS).

NOTE: Protruding from cable-tie F are the free ends of two shielded cables. Connect these cables as directed in the following steps.

4. (✓) At the free end of the shielded cable coming from cable-tie F and switch SW4, connect the inner lead to control AF lug 2 (S-1) and the shield lead to lug 1 (NS).
5. (✓) At the free end of the other shielded cable coming from cable-tie F, connect the inner lead to control AF lug 3 (S-1) and the shield lead to lug 1 (NS).

6. (✓) Remove all of the insulation from a 2" length of yellow wire.
7. (✓) Insert one end of this bare wire through control AF lug 1 (NS); then on to lug 4 (NS).

NOTE: When a wire passes through a connection and goes to another point, as in the preceding step, it will count as two wires in the solder instruction, one entering and one leaving the connection. When you solder this type connection, be sure you use enough solder and heat to properly solder the "through wire" and all other wires at the connection.

8. (✓) Solder all of the wires at control AF lug 1 (S-4). Position the free end of the wire out of the way for connection later.
9. (✓) Cut both leads of a .47  $\mu$ F Mylar capacitor to 3/4".
10. (✓) C305: Connect the prepared .47  $\mu$ F capacitor between control AF lugs 4 (S-3) and 8 (NS).

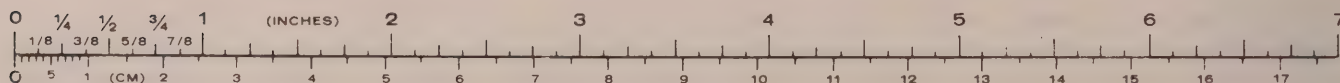
- (✓) Refer to inset drawing #2 on the Pictorial and install a female connector pin (#432-73) on one end of an 8-1/2" yellow wire.

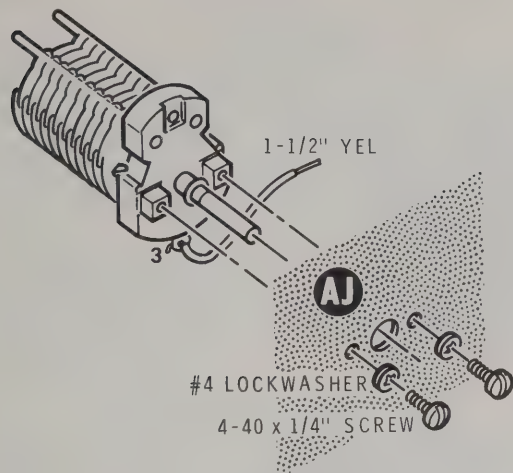
- (✓) Insert the connector pin into chassis connector BC hole 6. Push in on the pin until it locks in place in the connector.

- (✓) Connect the other end of the wire to control AF lug 7 (S-1).

- (✓) Connect a 6" yellow wire from circuit board hole E to control AF lug 8 (S-2).

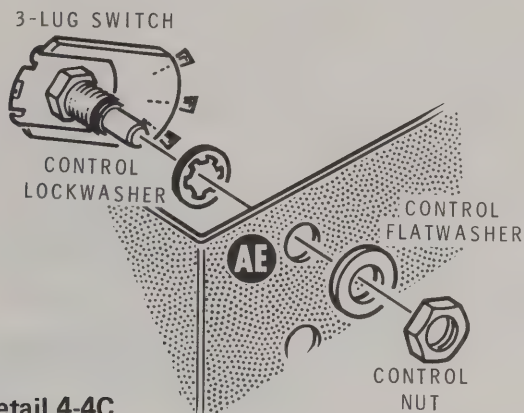
- (✓) Refer to Detail 4-4B and connect a 1-1/2" yellow wire to lug 3 (S-1) of the loading capacitor (#26-154) as shown.





Detail 4-4B

- (✓) C303: Refer to Detail 4-4B and install the prepared loading capacitor at AJ with 4-40 x 1/4" hardware. Position the capacitor as shown in the Pictorial. Also, be sure no wires or cables are caught under the capacitor.
- (✓) Connect the free end of the 1-1/2" yellow wire coming from lug 3 of this capacitor to switch SW2 pin 11 (S-1). NOTE: Be sure you position this wire so that, when the movable plates of the capacitor are turned, they will not hit the wire.
- (✓) Locate the shielded cable coming from cable-tie E. Then cut the shield lead off the free end of the cable.
- (✓) Connect the inner lead of this cable to capacitor AJ lug 2 (S-1).

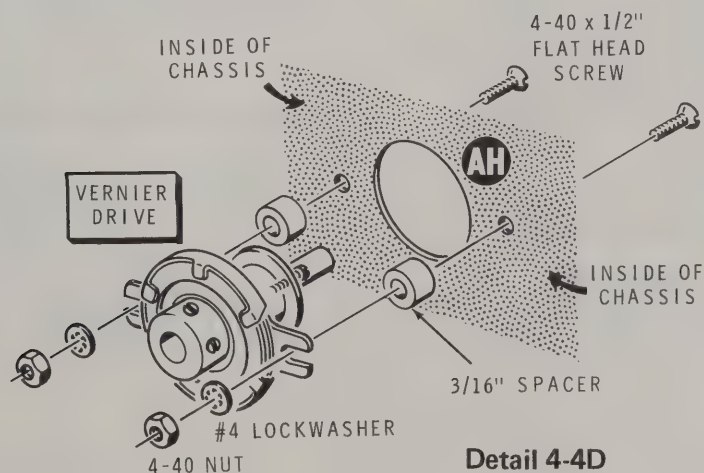


Detail 4-4C

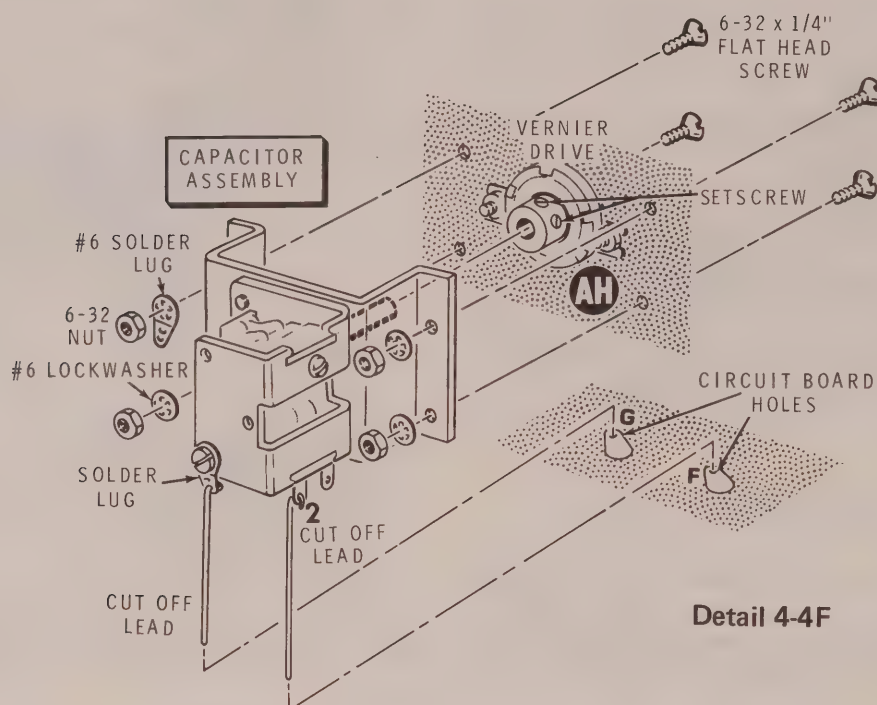
- (✓) SW302: Refer to Detail 4-4C and install a 3-lug rotary switch (#63-3) at AE. Position the switch so the space between lugs 1 and 2 is toward the screw at AD, as shown in the Pictorial.

Connect the 3-wire cable coming from cable-tie F (cable marked Y on the Pictorial) to switch AE as follows:

- (✗) Red to lug 3 (S-1).
- (✓) White to lug 2 (S-1).
- (✓) Black to lug 1 (S-1).
- (✓) Carefully press the wires down out of the way under the body of the switch.
- (✗) Refer to Detail 4-4D and mount the vernier drive (#100-1608) at AH with 4-40 x 1/2" hardware and 3/16" spacers. Be sure to center the vernier drive in the opening.



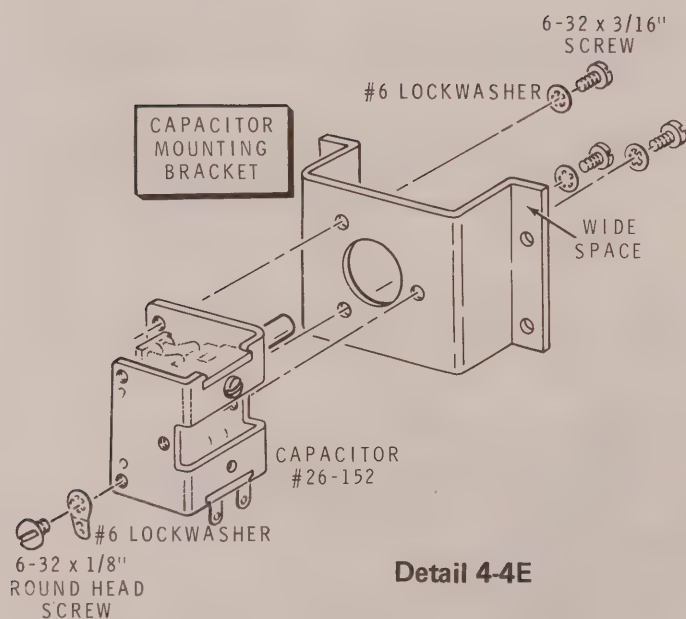
Detail 4-4D



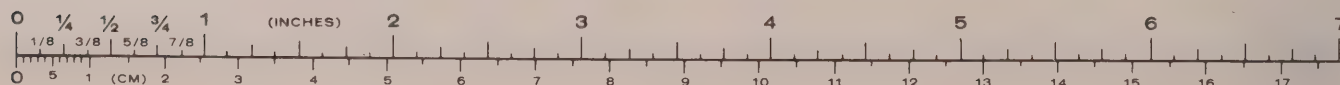
Detail 4-4F

**CAUTION:** Keep the rotor (movable plates) of the capacitor closed while you perform the following steps.

- (✓) C302A/B: Refer to Detail 4-4E and mount the VFO tuning capacitor (#26-152) on the capacitor mounting bracket with 6-32 x 3/16" hardware. **CAUTION:** Be sure you position the bracket so its wide space is located as shown.
- (✓) Mount a #6 solder lug on the capacitor frame with a 6-32 x 1/8" round head screw. Position the solder lug as shown in the Detail.
- (✓) Remove the insulation from two 1-1/2" yellow wires.
- (✓) Refer to Detail 4-4F and connect a 1-1/2" bare wire to the solder lug on the capacitor assembly as shown (S-1).
- (✓) In a similar manner, connect a 1-1/2" bare wire to lug 2 on the capacitor (S-1).



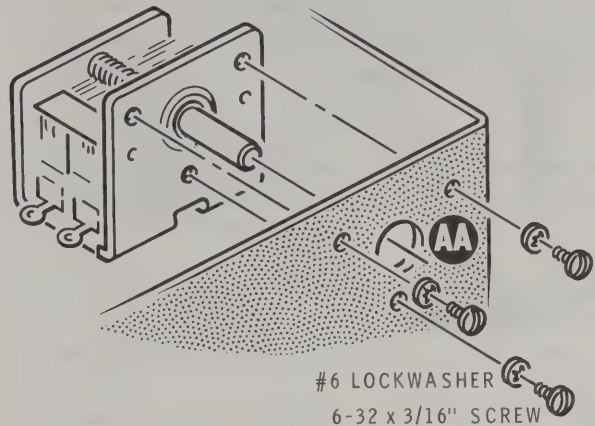
Detail 4-4E



# NOTES:

1. You will guide the bare wires on the capacitor assembly into holes in the circuit board when you mount the assembly in the following steps. At the same time, you will insert the shaft of the capacitor into the hole in the vernier drive.
2. Loosen the setscrews in the vernier drive just enough to allow the capacitor shaft to enter the hole in the drive. CAUTION: Be sure you do not lose the setscrews.
- (✓) Guide the two bare wires on the capacitor assembly into circuit board holes G and F, at the same time, insert the capacitor shaft into the hole in the vernier drive. See Pictorial 4-4 and Detail 4-4F.

- (✓) Refer to Detail 4-4F and mount the capacitor assembly at AA with 6-32 x 1/4" flat head hardware. NOTE: Use a #6 solder lug at AG instead of a lockwasher. Also, be sure none of the cables are pinched under the assembly.

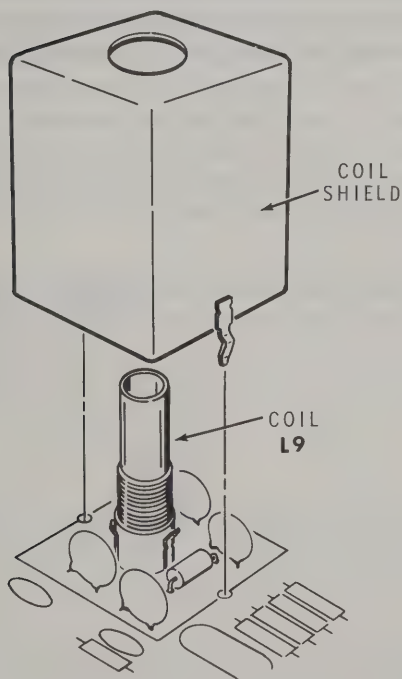


## Detail 4-4H

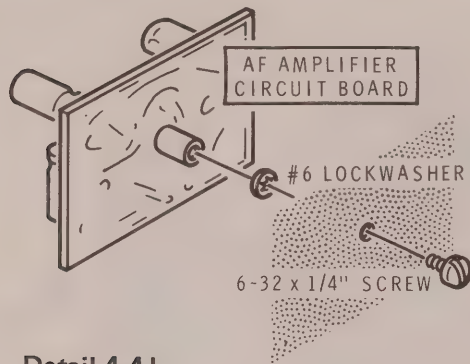
- (✓) Connect the free end of the bare wire coming from control AF lug 1 to solder lug AG (S-1).
- (✓) Locate the coil shield (#206-502). Then refer to Detail 4-4G and install the shield over coil L9 on the circuit board.

NOTE: Before you solder the wires in the next step, be sure you pull them as far as possible through the circuit board holes.

- (✓) Turn the Transceiver over and solder the shield lugs and the two bare wires protruding from the circuit board to the foil. Then cut off ONLY the excess wire lengths.
- (✓) C301A/B: Refer to Detail 4-4H and install a 2-section variable capacitor (#26-151) at AA with 6-32 x 3/16" hardware.
- (✓) Connect a 2-1/2" yellow wire from coil L1 lug 4 (S-1) to capacitor AA lug 1 (S-1).
- (✓) Connect a 3" yellow wire from circuit board hole A (S-1) to capacitor AA lug 2 (S-1).



## Detail 4-4G



Detail 4-4J

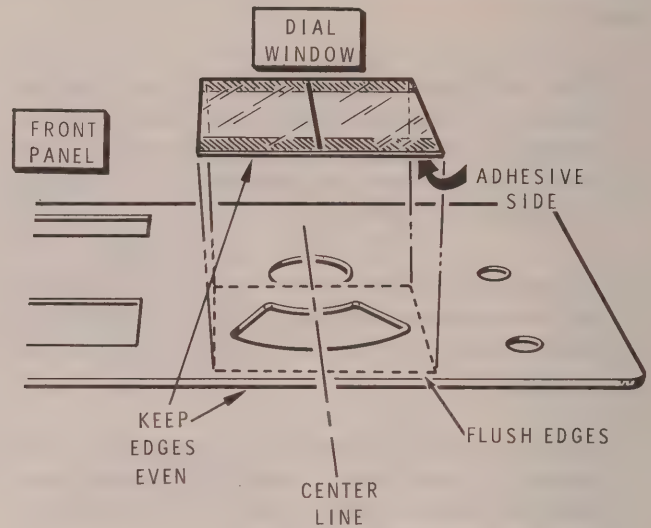
NOTE: In the next step, you will connect the free end of "the green wire," at the lower left corner of the chassis, to the circuit board of the previously set-aside AF amplifier assembly.

- (✓) Connect the free end of the green wire (coming from 3-wire cable X) to the hole marked IN on the AF amplifier circuit board (S-1).
- (✓) Refer to Detail 4-4J and mount the AF amplifier assembly at CB with 6-32 x 1/4" hardware. Position the assembly as shown in the Pictorial.

Refer to Pictorial 4-4 for the following steps.

Connect the free end of the wires coming from the AF amplifier assembly as follows:

- (✓) Wire from hole +12 to main circuit board hole VA (S-1).
- (✓) Wire from hole GND to jack BD lug 1 (S-2).
- (✓) Wire from hole OUT to jack BD lug 2 (S-2).



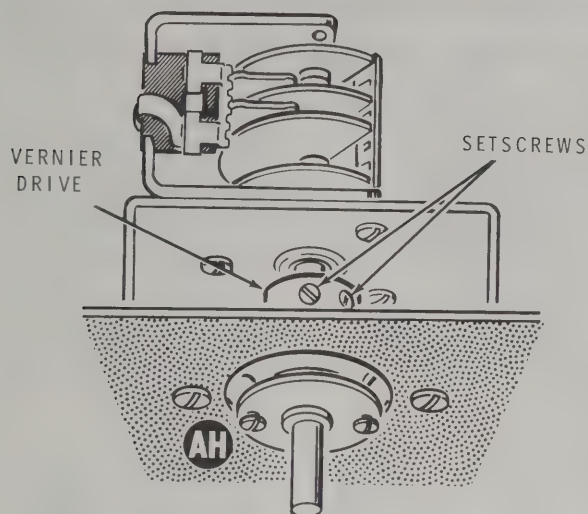
Detail 4-5A

## FRONT PANEL MOUNTING

- (✓) Refer to Detail 4-5A and mark the inside of the front panel as shown by the center line through hole AH.
- (✓) Remove the lengths of tape from the dial window (#446-602-1). Position the black line on the window over the line marked on the panel. Position the edge of the window even with the edge of the panel as shown. Then press the window firmly onto the panel. NOTE: Be careful you do not scratch the window.

Refer to Pictorial 4-5 in the Illustration Booklet for the following steps.

- (✓) Refer to Detail 4-5B and turn the shaft of vernier drive AH until its setscrews are positioned as shown.



Detail 4-5B

- (✓) Temporarily remove the two brass screws from the front of the vernier drive.
- (✓) Place the dial on the vernier drive so the scale of the dial is toward the right as shown in the Pictorial. Then secure the dial to the vernier drive with the previously removed brass screws. CAUTION: Do not scratch the face of the dial.
- (✓) Place the front panel on the chassis. Then secure it with control nuts at AE and AF. Be careful you do not scratch the panel when you tighten the control nuts.

## INSTALLING KNOBS

- (✓) Start 6-32 x 1/8" setscrews in the four small knobs.
- (✓) Start an 8-32 x 3/8" setscrew into the large knob.
- (✓) Turn the outer and inner shafts of control AF counterclockwise as far as they will go. NOTE: Be sure you turn the inner shaft until the switch clicks off.
- (✓) With the tab of the silver knob in the MIN position, press the knob onto the slotted outer shaft of control AF.

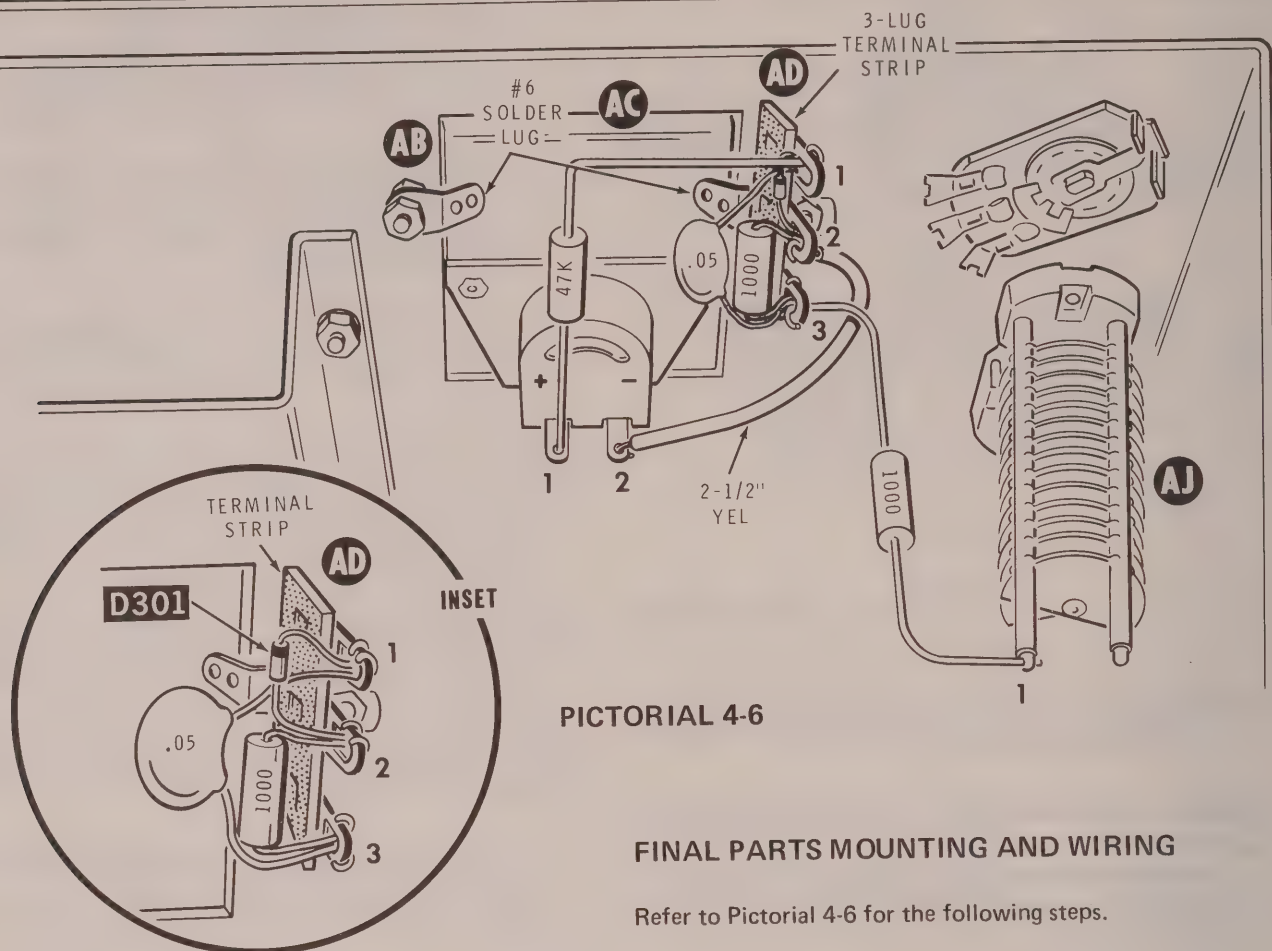
- (✓) Place the split bushing on the inner shaft of control AF; then press a small knob on the bushing. Turn the knob until its color dot is lined up with the word OFF on the panel and securely tighten the knob setscrew.
- (✓) Turn the shaft of capacitor AA fully counterclockwise and place a small knob on its shaft. Line up the color dot on the knob with the left scale-mark on the panel; then tighten the setscrew.
- (✓) Turn the shaft of switch AE fully clockwise and place a small knob on its shaft. Line up the color dot with the NARROW line on the panel and tighten the setscrew.
- (✓) Turn the shaft of capacitor AJ until the capacitor plates are fully meshed; then place a small knob on the shaft. Line up the color dot on the knob with the left scale-mark on the panel and tighten the setscrew.
- (✓) Place the large knob on the shaft of vernier drive AH and tighten the setscrew. NOTE: Be sure the knob turns freely and does not rub against the panel.

NOTE: When you perform the next step, be very careful you do not bend the plates of the capacitor.

- (✓) Carefully turn the rotor (movable plates) of the capacitor at AH fully clockwise (unmeshed).
- (✓) Turn the large knob CLOCKWISE until the mark to the left of the zero on the dial scale is lined up with the black line of the window.
- (✓) Refer to Detail 4-5B and securely tighten the two setscrews in the vernier drive.

NOTE: Do not forcefully rotate the tuning capacitor to its extreme end stops. This could damage the tuning capacitor plates.

- (✓) Rotate the large knob and turn capacitor AH to its full open or closed position; then continue to turn the large knob. The left or right end of the dial scale should stay lined up with the reference line of the window. NOTE: If the dial does not stay lined up, the capacitor shaft is slipping in the vernier drive. If this occurs, perform the previous two steps over again and make sure the set screws in the vernier drive are tight.

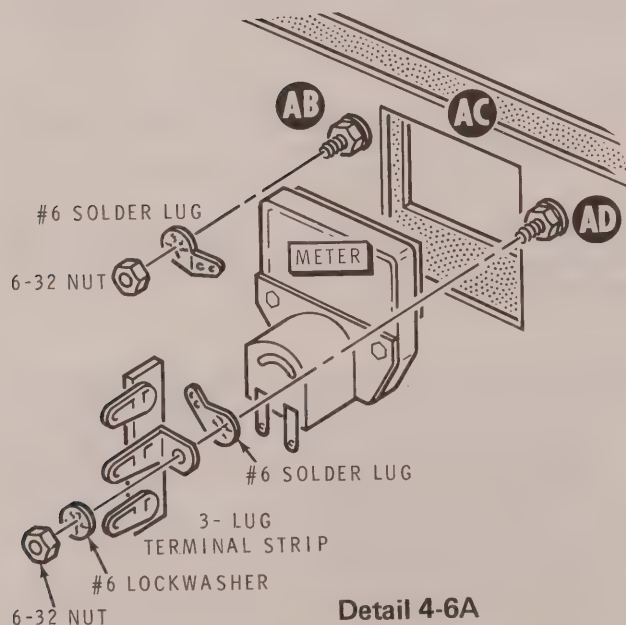


PICTORIAL 4-6

## FINAL PARTS MOUNTING AND WIRING

Refer to Pictorial 4-6 for the following steps.

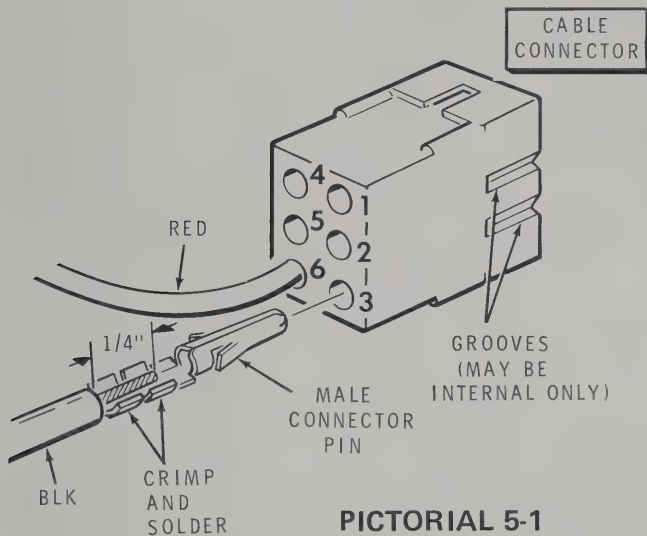
- (✓) Refer to Detail 4-6A and install the signal meter at AC. Use a #6 solder lug and 6-32 nut at AB. Use a #6 solder lug, 3-lug terminal strip, #6 lockwasher, and 6-32 nut at AD. NOTE: Be sure you position the terminal strip and solder lugs as shown in the Pictorial.
- (✓) R302: Connect a 1000  $\Omega$  (brown-black-red) resistor from capacitor AJ lug 1 (S-1) to terminal strip AD lug 3 (NS).
- (✓) Remove the shorting wire or clip between lugs 1 and 2 of meter AC.
- (✓) R305: Connect a 47 k $\Omega$  (yellow-violet-orange) resistor between meter AC lug 1 (S-1) and terminal strip AD lug 1 (NS).
- (✓) Connect a 2-1/2" yellow wire from meter AC lug 2 (S-1) to terminal strip AD lug 2 (NS).



Detail 4-6A

NOTE: Refer to the inset drawing on Pictorial 4-6 for the following steps.

- (✓) R303: Connect a 1000  $\Omega$  (brown-black-red) resistor between terminal strip AD lugs 3 (NS) and 2 (NS).
- (✓) D301: Connect the lead at the banded end of a 1N458 diode (#56-24) to terminal strip AD lug 1 (NS). Connect the other diode lead to lug 2 (S-3).
- (✓) C304: Connect a .05  $\mu$ F disc capacitor between terminal strip AD lugs 3 (S-3) and 1 (S-3).

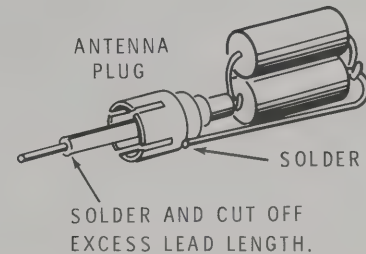
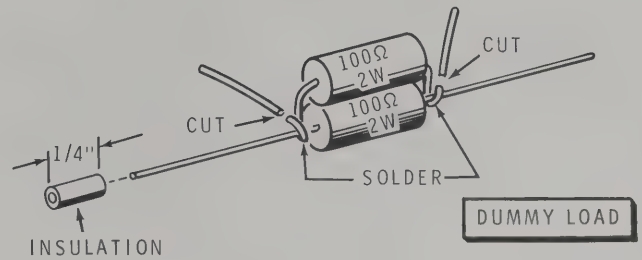


PICTORIAL 5-1

## PREPARING POWER CABLE

Refer to Pictorial 5-1 for the following steps.

- (✓) Remove 1/4" of insulation from each end of the red and the black wires supplied with the kit. Then twist the strands and apply a small amount of solder to the wire ends to hold the strands together. NOTE: Save one of the 1/4" lengths of insulation for use later.
- (✓) Install a male connector pin on one end of the red and one end of the black wires.
- (✓) Insert the connector pin on the black wire into hole 3 of the cable connector. Press the pin in until it locks in place in the cable connector.
- (✓) In the same manner, insert the connector pin on the red wire into hole 6 of the cable connector.



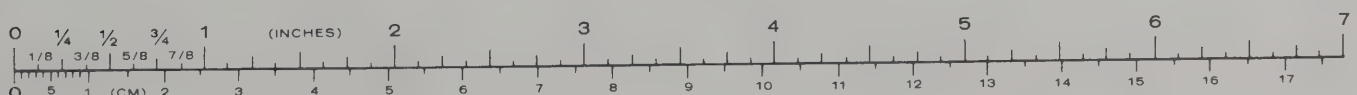
PICTORIAL 5-2

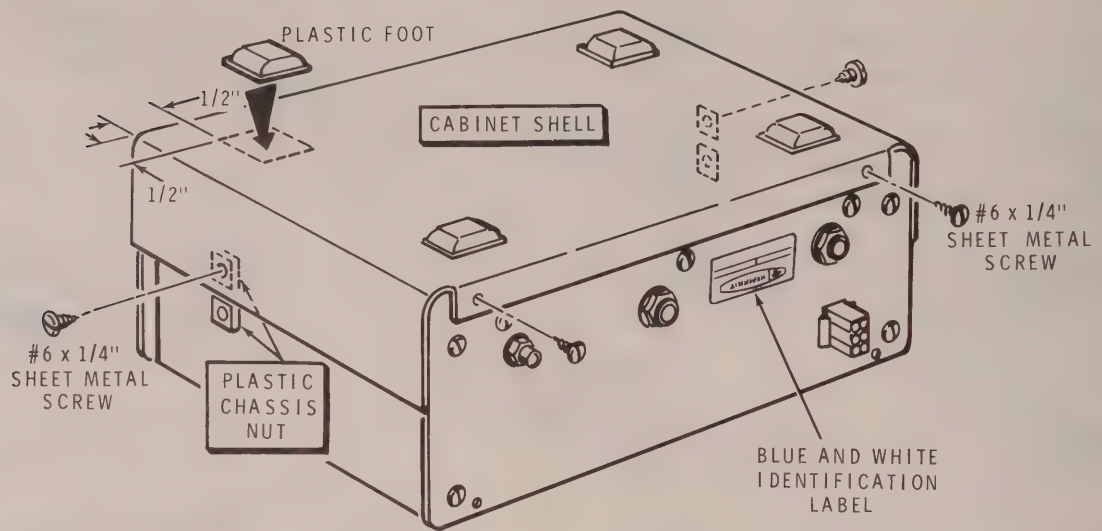
## PREPARING DUMMY LOAD

Refer to Pictorial 5-2 for the following steps.

- (✓) Locate the two 100  $\Omega$ , 2-watt (brown-black-brown) resistors. Bend the leads of one resistor around the leads of the other resistor as shown. Then solder both connections and cut off the indicated resistor leads.
- (✓) Place the previously saved 1/4" length of insulation on one lead of the resistor assembly.
- (✓) Insert this lead of the assembly into the antenna plug as shown. Then solder the lead to the pin. NOTE: Apply heat to the tip of the pin only long enough to allow the solder to flow into the pin. Allow the connection to cool; then cut off the excess lead length.
- (✓) Bend the other lead as shown. Then solder the lead to the shell of the antenna plug.

This completes the wiring of your Transceiver. Carefully inspect all connections for loose wires or unsoldered connections. Remove any wire clippings or solder splashes.





PICTORIAL 5-3

Refer to Pictorial 5-3 for the following steps.

- (✓) Place a cabinet shell on the bottom of the Transceiver. Secure the shell with four #6 x 1/4" sheet metal screws at the rear and sides of the Transceiver.
- (✓) Remove the protective backing from a plastic foot. Then press the foot onto the corner of the bottom cabinet shell as shown.
- (✓) In a similar manner, install a plastic foot at each remaining corner.

NOTE: The blue and white identification label you will install in the next step shows the model number and production series number of your kit. Refer to these numbers in any communications you may have with the Heath Company regarding your kit. This will assure you of receiving the most up-to-date information in return.

- (✓) Carefully remove the backing paper from the blue and white label. Then press the label on the rear panel at the indicated location. Place the backing paper over the label and then firmly press the label on the panel.

Proceed to the "Initial Tests."

# INITIAL TESTS

The following tests are performed on your Transceiver to make sure it is operating properly before you begin alignment. If you do not obtain the indicated results at any time, turn the Transceiver off and refer to the "In Case of Difficulty" section on Page 69.

You will need a pair of high impedance (about 2000  $\Omega$ ) headphones, a key, and a 13.4-volt DC power supply to complete the Initial Tests and Alignment.

Refer to Figure 1-2 in the Illustration Booklet for the following steps.

- ( ) Set all of the front panel controls fully counterclockwise.
- ( ) Set the SIDETONE LEVEL control to the center of its rotation.
- ( ) Push the 7.0 MHz band switch in.
- ( ) Connect the 50  $\Omega$  dummy load to the ANTENNA socket on the rear panel.
- ( ) Connect a pair of headphones to the HEADPHONE jack on the rear panel.
- ( ) Connect the key to the KEY jack on the rear panel.
- ( ) Plug the power cable onto the POWER socket on the rear panel.
- ( ) Connect the power cable red lead to the + (positive) terminal and the black lead to the — (negative) terminal of a 13.4 VDC power source. CAUTION: Be sure you observe the correct polarity; otherwise the transistors in the Transceiver will be damaged.
- ( ) Turn the Transceiver power on by rotating the AF GAIN control clockwise until it "clicks" on.
- ( ) Turn the AF GAIN control to the center of its rotation. Noise should be heard in the headphones.
- ( ) Key the Transceiver. The relay should click and a sidetone should be heard in the headphones. Adjust the SIDETONE VOLUME control on the circuit board for a comfortable listening level. Release the key.
- ( ) Turn the AF GAIN control counterclockwise until it "clicks" off.

This completes the Initial Tests. Proceed to the "Alignment" section. Do not disconnect the power supply, key, or headphones from the Transceiver.

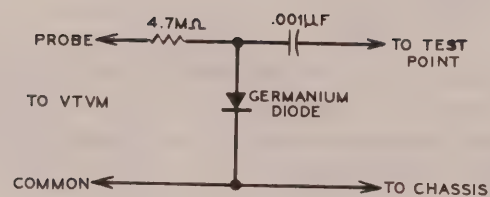


Figure 1-3

# ALIGNMENT

The following alignment procedure requires the use of a calibrated Receiver capable of receiving 7.0 to 7.25 MHz, an RF Signal Generator, and a VTVM with an RF Probe. If a Signal Generator is not available, use an on-the-air signal. Figure 1-3 is a schematic of a simple RF Probe which you can make if one is not available. CAUTION: A cabinet shell must be installed on the bottom of the Transceiver before you start the following procedure.

Refer to Figure 1-2 in the Illustration Booklet for the following procedures.

## HFO (Heterodyne Frequency Oscillator)

- ( ) Connect the RF probe of the VTVM to test point TP1. This is the lead at the indicated end of resistor R94, a 68 k $\Omega$  (blue-gray-orange) resistor.
- ( ) Turn the Transceiver on and press the 3.5 MHz pushbutton.

NOTE: You can reach the bottom slug in coils L17/L18 and L19/L21 by inserting the longer end of the alignment tool through the top slug; then on down to the bottom slug. Be careful when you do this so that you do not damage or turn the top slug.

- ( ) Use the smaller alignment tool and adjust the bottom slug in coil L17/L18 to obtain a peak reading on the VTVM. Then turn the slug an additional 1/4 turn clockwise. The VTVM should read approximately 0.3 volts.
- ( ) Press the 7.0 MHz pushbutton.
- ( ) Adjust the top slug in coil L17/L18 to obtain a peak reading on the VTVM. Then turn the slug an additional 1/4 turn counterclockwise. The meter should read approximately 0.3 volts.
- ( ) Press the 14.0 MHz pushbutton.
- ( ) Adjust the bottom slug in coil L19/L21 to obtain a peak reading on the VTVM. Then turn the slug an additional 1/4 turn clockwise. The VTVM should read approximately 0.2 volts.
- ( ) Press the 21.0 MHz pushbutton.
- ( ) Adjust the top slug in coil L19/L21 to obtain a peak reading on the VTVM. The VTVM should read approximately 0.2 volts. Then turn the slug 1/4 turn counterclockwise.
- ( ) Disconnect the VTVM from the Transceiver.

## VFO (Variable Frequency Oscillator)

- ( ) Turn the calibrated receiver on and allow it to warm up. Tune the receiver to approximately 7.0 MHz.
- ( ) Press the 7.0 MHz pushbutton on the Transceiver.
- ( ) Connect one end of a suitable length of wire to the antenna terminal on the calibrated receiver. Loop the other end of this wire around coil L19/L21 as shown in inset drawing #2 on Figure 1-2.
- ( ) Turn the Transceiver on and allow it to warm up for at least 30 minutes before you proceed with the following adjustments.

NOTE: In the following steps, you will zero beat the calibrated receiver; first against its own crystal calibrator, and then against the Transceiver. A zero beat is a point where the two frequencies being combined (or beat against each other) are exactly the same. As you approach zero beat, the tone caused by the two combined frequencies will gradually decrease in pitch and volume until it stops. This point is very sharp so you must tune very carefully.

- ( ) Set the calibrated receiver's Function switch to the SSB or CW position.
- ( ) Tune the calibrated receiver to 7.0 MHz. Then turn on its crystal calibrator and zero beat the receiver frequency against the crystal calibrator frequency.
- ( ) Turn off the crystal calibrator. NOTE: Be careful that you do not change the setting of the receiver frequency.
- ( ) Refer to inset drawing #1 of Figure 1-2 and insert the metal blade (#205-778) into the small end of the plastic nut starter.

NOTE: Use the alignment tool that you made from the nut starter and blade for all trimmer adjustments. DO NOT use a screwdriver.

- ( ) Turn the Transceiver tuning dial to 0.
- ( ) Adjust trimmer capacitor C302B until you hear a zero beat from the calibrated receiver.

- ( ) Turn the Transceiver dial to 250.
- ( ) Turn the calibrated receiver dial to 7.250 MHz.
- ( ) Use the larger alignment tool to turn the slug in coil L9 until you hear a zero beat from the calibrated receiver. It may be necessary to turn down the calibrated receiver's AF gain control.
- ( ) *Repeat the VFO alignment steps several times until the calibrated receiver's dial coincides with the 0 and 250 marks on the Transceiver's dial.*
- ( ) Turn off the calibrated receiver and remove the wire from around coil L19/L21 in the Transceiver. The calibrated receiver will no longer be used.

## MIXER AMPLIFIER

- ( ) Turn the Transceiver tuning dial to 100.
- ( ) Connect the RF Probe of the VTVM to test point TP2. This is the lead at the indicated end of R49, a 270  $\Omega$  (red-violet-brown) resistor.
- ( ) Press the 3.5 MHz pushbutton and adjust coil L13 for a peak reading on the VTVM.
- ( ) Press the 7.0 MHz pushbutton and adjust coil L14 for a peak reading on the VTVM.
- ( ) Press the 14.0 MHz pushbutton and adjust coil L15 for a peak reading on the VTVM.
- ( ) Turn the Transceiver tuning dial to 150.

NOTE: When you perform the next step, you may have to turn the coil slug several turns counterclockwise before you obtain a peak reading on the VTVM.

- ( ) Press the 21.0 MHz pushbutton and adjust coil L16 for a peak reading on the VTVM.
- ( ) Disconnect the RF Probe from Test point TP2.

## TRANSMITTER

- ( ) Plug the previously prepared 50  $\Omega$  dummy load into the ANTENNA socket on the back of the Transceiver. (This may already be connected to the Transceiver.)

- ( ) Connect the key to the KEY jack on the back of the Transceiver. (This also may already be connected to the Transceiver.)

NOTE: Use the alignment tool that you made from the nut starter and blade for all trimmer adjustments. DO NOT use a screwdriver.

- ( ) Turn the screws in trimmers C95, C99, C103, and C106 clockwise until they stop turning. Do not force the screws.

- ( ) Turn the screw in trimmer C95 1/2 turn counterclockwise.

- ( ) Turn the screw in trimmer C99 1/8 turn counterclockwise.

- ( ) Turn the screw in trimmer C103 1 turn counterclockwise.

- ( ) Turn the screw in trimmer C106 1/4 turn counterclockwise.

- ( ) Make sure the TUNING dial is set to 100. ✓

- ( ) Press the 3.5 MHz pushbutton. ✓

- ( ) Set the LOADING control on the front panel to the 12 o'clock position.

NOTE: In the following steps, the adjustments will be quite broad.

- ( ) Key the Transceiver and adjust trimmer C95 for a maximum reading on the RELATIVE POWER meter.

- ( ) Key the Transceiver and adjust the LOADING control on the front panel to obtain a maximum reading on the RELATIVE POWER meter.

- ( ) Repeat the previous two steps.

- ( ) Press the 7.0 MHz pushbutton. ✓

- ( ) Set the LOADING control to the 12 o'clock position.

- ( ) Key the Transceiver and adjust trimmer C99 to obtain a maximum reading on the RELATIVE POWER meter.

- ( ) Key the Transceiver and adjust the LOADING control on the front panel to obtain a maximum reading on the RELATIVE POWER meter.

- ( ) Repeat the previous two steps.

- ( ) Press the 14.0 MHz pushbutton. ✓

- ( ) Set the LOADING control to the 12 o'clock position.

- ( ) Key the Transceiver and adjust trimmer C103 to obtain a maximum reading on the RELATIVE POWER meter.

- ( ) Key the Transceiver and adjust the LOADING control on the front panel to obtain a maximum reading on the RELATIVE POWER meter.

- ( ) Repeat the previous two steps.

- ( ) Press the 21.0 MHz pushbutton. ✓

- ( ) Set the LOADING control to the 12:00 o'clock position.

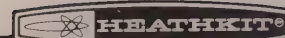
- ( ) Key the Transceiver and adjust trimmer C106 to obtain a maximum reading on the RELATIVE POWER meter.

- ( ) Key the Transceiver and adjust the LOADING control to obtain a maximum reading on the RELATIVE POWER meter.

- ( ) Repeat the previous two steps.

- ( ) Turn the Transceiver off.

- ( ) Disconnect the key and dummy load from the Transceiver.



## RECEIVER

- ( ) Connect a pair of headphones to the HEADPHONES jack on the back of the Transceiver.

NOTE: You may use a nearby accurately calibrated transmitter for the following adjustments. If you do use one, connect a small piece of wire to the Transceiver's antenna socket. The small wire will act as a simple antenna. (You may also use an appropriate antenna.)

- ( ) Connect a signal generator to the ANTENNA socket on the back of the Transceiver.
- ( ) Turn the signal generator on and allow it to warm up.
- ( ) Set the Transceiver tuning dial to 250.
- ( ) Set the RECEIVER PRESELECTOR to 14.
- ( ) Set the RF GAIN control to MAX.
- ( ) Turn the Transceiver on and adjust the AF GAIN control for a comfortable listening level.

NOTE: In the following steps, as you approach the point of resonance of a trimmer capacitor or coil, the sound from the headphones will increase. As this occurs, decrease the output of the signal generator to the lowest level that you can still hear. This will prevent overloading the receiver.

- ( ) Press the 3.5 MHz pushbutton.
- ( ) Adjust the signal generator frequency to approximately 3.750 MHz or until you hear the signal in the headphones. The output of the generator may have to be quite high.
- ( ) Alternately adjust trimmers C3 and C16 for maximum sound in the headphones.
- ( ) Press the 7.0 MHz pushbutton.

- ( ) Adjust the signal generator frequency to approximately 7.25 MHz or until you hear it in the headphones. The output of the generator may have to be quite high.

- ( ) Alternately adjust trimmers C6 and C19 for maximum sound in the headphones.

- ( ) Set the Transceiver tuning dial to 100.

- ( ) Adjust the signal generator frequency to approximately 7.100 MHz or until you hear it in the headphones.

- ( ) Adjust the RECEIVER PRESELECTOR for maximum sound in the headphones.

- ( ) Readjust trimmer C6 for maximum sound in the headphones. NOTE: Do not adjust trimmer C19.

- ( ) Press the 14.0 MHz pushbutton.

- ( ) Set the Transceiver tuning dial to 250.

- ( ) Set the RECEIVER PRESELECTOR to 14.

- ( ) Adjust the signal generator frequency to approximately 14.25 MHz or until you hear it in the headphones.

- ( ) Alternately adjust trimmers C7 and C22 for maximum sound in the headphones.

- ( ) Press the 21.0 MHz pushbutton.

- ( ) Adjust the signal generator frequency to approximately 21.25 MHz or until you hear it in the headphones.

- ( ) Alternately adjust trimmers C9 and C24 for maximum sound in the headphones.

- ( ) Turn the Transceiver off.

- ( ) Disconnect the signal generator from the Transceiver.

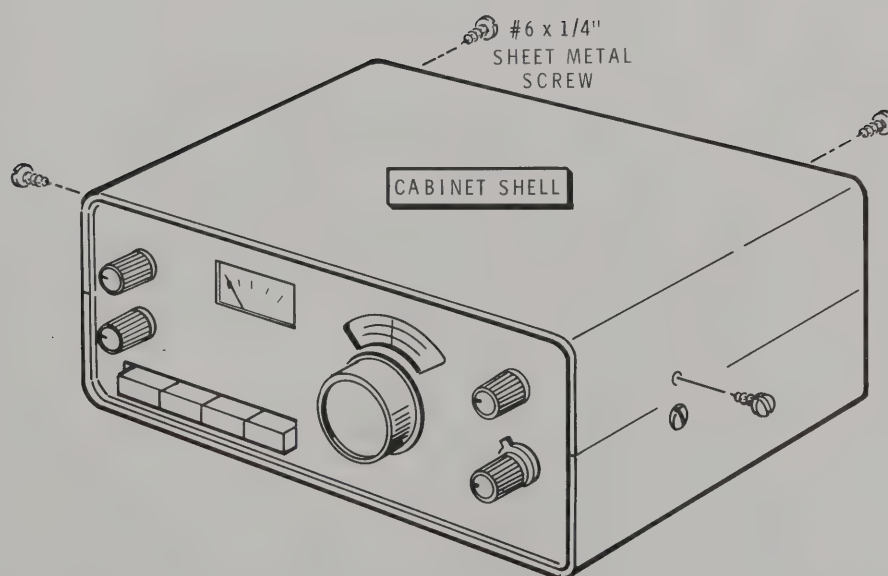
This completes the "Transceiver Alignment." Proceed to "Final Assembly."

# FINAL ASSEMBLY

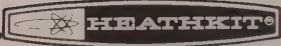
Refer to Pictorial 5-4 for the following steps.

- ( ) Place the remaining cabinet shell on the Transceiver as shown.
- ( ) Secure the cabinet shell to the Transceiver with #6 x 1/4" sheet metal screws at the rear and sides as shown.

This completes the assembly of your Transceiver. Proceed to "Operation."



PICTORIAL 5-4



1.000 1.000 1.000



# OPERATION

Refer to Figure 1-2 for the following steps.

- ( ) Plug the power cable onto the POWER socket on the rear panel.
- ( ) Connect the power cable red lead to the + (positive) terminal and the black lead to the — (negative) terminal of a 13.4 VDC power source. CAUTION: Be sure you observe the correct polarity; otherwise the transistors in the Transceiver will be damaged.
- ( ) Connect a key to the KEY jack on the rear panel.
- ( ) Connect an antenna to the ANTENNA socket on the rear panel. (See the following information on antennas.)
- ( ) Connect a pair of headphones to the HEADPHONES jack on the rear panel.

## ANTENNAS

The Transceiver should be used with 50 ohm to 75 ohm antennas having a low VSWR. Lightweight hookup wire dipoles and inverted vee's are sufficient for solid contacts. They can be quickly strung up for camping trips and emergency operation, as well as field day use. However, antennas of the beam and quad type will provide a significant improvement in performance, much more so than for medium to high-power rigs.

The "ARRL Antenna Book" is commonly available and includes comprehensive reference work on transmission lines and antennas. Other similar handbooks for the amateur are offered for sale and can often be found in a public library.

- ( ) Push in the Band switch for the band you intend to operate on.
- ( ) Turn the Transceiver on by rotating the AF GAIN control clockwise until it "clicks" on. Then continue to rotate the control clockwise to a comfortable listening level.
- ( ) Adjust the Main Tuning to the portion of the band where you intend to operate.

NOTE: When tuning across the band, always go to the high end of the band first and tune down to the low end. This is to assure that you will be on the high side of the zero beat when listening to a signal. Otherwise you may answer a CQ on the low side of zero beat and your transmitting frequency will be too low.

- ( ) Listen to the headphones and adjust the RECEIVER PRESELECTOR for maximum signal loudness (fully clockwise for 15 and 20 meter operation).
- ( ) Key the Transceiver and rotate the LOADING control to obtain a maximum meter indication. The Transceiver is now ready for on-the-air operation.

## OPERATING HINTS

When operating a QRP (low power) rig, your transmitted signal may be below the signal level preferred by most operators. Generally, lower power signals lose out unless a few simple techniques are followed. In many cases, listening for a CQ is more acceptable since your signal has a greater chance of being copied this way. Or you can try to contact a station just after he completes a contact. Also, be sure that you are on the high side of zero beat when you transmit as described previously.

Emergency operation is sometimes a necessity and always unexpected. The Transceiver is well suited for these situations if an antenna is available. A power source is usually no problem since any automobile battery or lantern

batteries of the appropriate voltage can provide hours of dependable operation. Refer to the "Specifications" section for voltage and current requirements.

You can vary the hold-in time of the antenna relay by adjusting BREAK-IN DELAY control R68 on the main circuit board. Adjust this control to obtain the desired delay after you have released the key.

Look for QRP operators on the following frequencies:

3.554 MHz	21.040 MHz
7.040 MHz	28.040 MHz
14.065 MHz	

# IN CASE OF DIFFICULTY

This part of the Manual will help you locate and correct any difficulties which might occur. This information is divided into:

Visual Checks.

Precautions for Bench Testing.

Troubleshooting Chart.

**NOTE:** If you prefer to have your Transceiver repaired at the factory or at one of the Heathkit Electronic Centers, or if you need additional information before you proceed, refer to the "Customer Service" information inside the rear cover of this Manual. Your Warranty is located inside the front cover.

## VISUAL CHECKS

1. About 90% of the kits that are returned for repair do not function properly due to poor soldering. Therefore, you can eliminate many troubles by a careful inspection of connections to make sure they are soldered as described on Page 6 of this Manual and in the "Kit Builders Guide." Reheat any doubtful connections and be sure all the wires are soldered at places where several wires are connected. Check carefully for solder bridges between circuit board foils.
2. Check to be sure that all transistors and diodes are in their proper locations, and are installed correctly.
3. Check the value of each part. Be sure that the proper part has been wired into the circuit, as shown in the Pictorial diagrams and as specified in the wiring instructions. It would be easy, for example, to install a 220  $\Omega$  (red-red-brown) resistor in a step that calls for a 22 k $\Omega$  (red-red-orange) resistor.
4. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as you check it. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you have consistently overlooked.
5. Check all of the wires that are connected to the circuit board to be sure they do not touch the chassis or other lugs. Make sure all wires are properly soldered.
6. A review of the "Circuit Description" may help you to determine the problem.
7. If the difficulty still is not cured, read the "Precautions for Bench Testing" section, and the section titled "Troubleshooting Charts."

## PRECAUTIONS FOR BENCH TESTING

NOTE: Use a high input impedance voltmeter for voltage measurements.

1. Be cautious when testing transistor circuits. Although transistors have almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than other circuit components.
2. Be sure you do not short circuit any terminals when you make voltage measurements. If the probe should slip, for example, and short out a bias or voltage supply point, it is almost certain to damage one or more transistors or diodes.
3. Do not remove any components while the kit is operating; this could cause considerable damage.

If you make repairs to your Transceiver, make sure you eliminate the cause as well as the effect of the trouble. If, for example, you should find a damaged resistor, be sure to find out what caused the resistor to become damaged. If the cause is not eliminated, the replacement resistor may also become damaged when the Transceiver is put back into operation.

## Troubleshooting Chart

The following chart lists conditions and possible causes of several specific malfunctions. If a particular part is mentioned (Q7 for example) as a possible cause, check that part to see that it is installed and/or wired correctly. It is also possible, on rare occasions, for a part to be faulty and require replacement.

CONDITION	POSSIBLE CAUSE
No signals can be received on any band. However, headphone noise is heard when the AF Gain control is advanced.	1. Transistor Q1 or IC1 is incorrectly installed or shorted.
No signals are received on the 3.5 MHz band.	1. Diode D1 or D5 incorrectly installed or shorted.
No signals are received on the 7.0 MHz band.	1. Diode D2 or D6 incorrectly installed or shorted.
No signals are received on the 14.0 MHz band.	1. Diode D3 or D7 incorrectly installed or shorted.
No signals are received on the 21.0 MHz band.	1. Diode D4 or D8 incorrectly installed or shorted.
No sound of any kind from the headphones.	1. Transistor Q201 or IC2 incorrectly installed or shorted. 2. Phone jack J301 incorrectly wired.
Heterodyne frequency oscillator does not operate on any band.	1. Transistor Q6 incorrectly installed or shorted.
Heterodyne frequency oscillator does not operate on one band. (Other bands are OK.)	1. The associated diodes for the inoperative band (D22 thru D29) may be incorrectly installed or shorted. 2. The crystal for the inoperative band may be faulty.

## TROUBLESHOOTING CHART (cont'd.)

CONDITION	POSSIBLE CAUSE
Sidetone does not operate.	1. Diode D21 or IC2 is incorrectly installed or shorted.
Relay does not operate.	1. Transistor Q12 or Q13 is incorrectly installed or shorted.
Relative power meter does not operate.	1. Trimmer capacitors, C95, C99, C103, C106, and C303 are not properly adjusted. 2. Transistor Q8, Q9, or diode D301 are incorrectly installed or shorted.
Relative power meter does not operate on one band only.	1. The trimmer capacitor for that band (C95, C99, C103, or C106) is not properly adjusted. 2. The diode associated with that band is incorrectly installed or shorted. (Diodes D16, D17, D18, D19, D31, D32, D33, D34, D35, D36, D37, or D38.) 3. The heterodyne frequency oscillator is not properly tuned for that band.

# SPECIFICATIONS

## TRANSMITTER

DC Power Input	
80 meters . . . . .	3.5 watts.
40 meters . . . . .	3.0 watts.
20 meters . . . . .	3.0 watts.
15 meters . . . . .	2.5 watts.
Frequency Control . . . . .	Built-in VFO.
Output Impedance . . . . .	50 $\Omega$ unbalanced.
Sidetone . . . . .	Built-in, adjustable volume.
Spurious and Harmonic Levels . . . . .	At least 35 db down.
Transmit Frequency Offset . . . . .	Approximately 750 Hz lower, fixed on all bands.

## RECEIVER

Receiver Type . . . . .	Direct conversion with RF amplifier, balanced product detector, and active audio filter.
Sensitivity . . . . .	1 microvolt or less for 10 dB $\frac{S+N}{N}$ . 0.2 $\mu$ V provides readable signal.
Selectivity . . . . .	Wide — 750 Hz @ 6 dB down. Narrow — 375 Hz @ 6 dB down.
Passband Center Frequency . . . . .	750 Hz.
Type of Reception . . . . .	CW.
Audio Output Impedance . . . . .	1000 $\Omega$ nominal.

## GENERAL

Frequency Coverage . . . . .	80 meters, 3.5 to 3.75 MHz. 40 meters, 7.0 to 7.25 MHz. 20 meters, 14.0 to 14.25 MHz. 15 meters, 21.0 to 21.25 MHz.
Frequency Stability . . . . .	Less than 150 Hz/hour drift after 60 minute warm-up.
Frequency Generation . . . . .	Premixed VFO and HFO.
Power Requirements . . . . .	13.4 volts DC, nominal. 90 mA receive mode, and 430 mA transmit mode.
Dimensions . . . . .	9-1/4" wide x 8-1/2" deep x 4-1/4" high, including knobs and feet. (23.5 cm wide x 21.6 cm deep x 10.8 cm high.)
Weight . . . . .	4 lbs. (1.8 kg.)

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The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

# CIRCUIT DESCRIPTION

Refer to the Schematic Diagram and the Block Diagram in the Illustration Booklet while you read the following description.

The Transceiver operates in the CW portion of the 15, 20, 40, and 80 meter amateur bands. The frequencies are generated by the combined efforts of the VFO and the heterodyne oscillator for both transmit and receive operation. In the following paragraphs, each part of the Transceiver circuitry will be discussed in detail.

## VFO

FET (field effect transistor) Q2 and its associated circuitry forms a Hartley oscillator. Part of coil L9, tuning capacitor C302, and temperature compensating capacitors C44, C45, C46, C47, C48, C49, and C51 determine the frequency of the oscillator. The other part of L9 is a feedback circuit that couples part of the generated signal back to the gate of FET Q2 to help sustain oscillation. The VFO generates frequencies from 8.645 MHz to 8.895 MHz.

Diode D9 clamps the positive-going half of the signal to prevent FET Q2 from reaching high peak operating currents. This helps to keep the VFO from generating harmonic frequencies.

The signal from the VFO is coupled through capacitor C54 and C56 to emitter follower transistor Q3. This transistor provides isolation for the VFO. The output from the emitter of transistor Q3 is coupled to the balanced mixer.

When the Transmitter is keyed, diode D11 effectively adds capacitor C55 to the circuit which causes a shift in the VFO frequency. This produces a fixed offset during transmit. Zener diode ZD1 provides voltage regulation for the drain of FET Q2.

## HFO

The HFO operates at any of four crystal-controlled frequencies, depending on which band switch is depressed. These frequencies, when mixed with the VFO frequency, establish the four bands of operation.

When the 3.5 MHz pushbutton switch on the front panel is depressed, crystal Y1 and its associated circuitry are electrically connected to transistor Q6 to form the HFO. At this time power is supplied to the circuit through resistor R78 and crystal Y1 oscillates at a frequency of 12.395 MHz, which is coupled through diode D22 to transistor Q6. A part of the signal from the collector of transistor Q6 is coupled back through diode D23 and through the tuned circuit composed of coil L17 and capacitor C116 to sustain oscillation. Diodes D22 and D23 prevent DC from activating this crystal circuit when a different crystal circuit is being used. The HFO operates similarly on the other bands.

The HFO signal is coupled through capacitor C127 to emitter follower transistor Q7. This transistor provides isolation for the oscillator circuit to prevent loading. From the emitter of transistor Q7, the signal is coupled to the balanced mixer.

## BALANCED MIXER

Coils L11 and L12 and diodes D12, D13, D14, and D15 form a balanced mixer which combines the VFO and HFO signals. This produces four signals at the output of the balanced mixer. These are the VFO frequency plus the HFO frequency, the HFO frequency minus the VFO frequency, the VFO frequency, and the HFO frequency. The only frequency that we are concerned with is the HFO frequency minus the VFO frequency.

## MIXER AMPLIFIER

The four signals are then coupled through capacitor C61 to FET Q4 where they are amplified and then coupled to the four diode-selected filter circuits. Only one filter circuit is electrically connected to the circuit on any one band. For example, if the 3.5 MHz pushbutton switch on the front panel is depressed, coil L13 and capacitor C64 are electrically connected to the circuit. This tuned circuit filters out the three unwanted signals and leaves only the "on-frequency" signal, which is coupled through capacitor C73 to transistor Q5.

Transistor Q5 is connected as an emitter follower which provides isolation and impedance matching. The output from the emitter of Q5 is coupled through C75 to transistor Q8 and also through capacitor C28 to balanced product detector IC1.

## TRANSMITTER

The output of driver transistor Q8 is resonance-tuned by the appropriate diode-switched tuned circuit. Here again, there are four tuned circuits. Only one tuned circuit is electrically connected to the output of Q8 for each band of operation. For the 3.5 MHz band, coil L22 and capacitor C77 and C78 are connected through diodes D31 and D35.

The output from the driver is coupled to final amplifier transistor Q9. Here the signal is amplified and then coupled through the appropriate switch (part of the depressed front panel switch) to the output circuit, which acts as a bandpass filter and impedance matching network.

Zener diode ZD2 prevents excessive collector RF voltage from destroying transistor Q9 if the operator should mistakenly key the transmitter when there is no load present on the output of the Transmitter, or when the SWR is high.

Capacitor C303 is the Loading control and is adjusted for maximum power on the relative power meter. The RF power output is then coupled through antenna switching relay RL1 and to antenna jack J302. A small part of the RF power output is coupled through resistor R302, and capacitor C304 to the relative power meter. This output power is rectified by diode D301.

## KEYING

Transistor Q11 provides a keying function when the key is depressed. This transistor provides the keying for the transmitter driving stage, the sidetone oscillator, the break-in delay switching, and the receiver muting. When the key is depressed, the keying transistor places a B+ voltage on the collector of driver transistor Q8 and switches it on. The transmitter is then keyed and provides an RF output signal.

Also, when the key is depressed, pin 11 of sidetone oscillator IC2D is connected to ground through resistor R72 and diode D21 and the key to cause the oscillator to turn on and generate an audible tone. This tone is coupled through capacitor C111, resistor R76, Sidetone Level Adjust control R77, and capacitor C113 to the headphone jack.

## BREAK-IN DELAY

Transistors Q12 and Q13 provide an adjustable delay circuit for antenna switching and receiver muting. The emitter of break-in delay transistor Q12 is connected to ground when the key is depressed. This effectively puts the collector of Q12 at ground potential, which causes relay driver transistor Q13 to energize relay RY1 and switch the antenna from receive to transmit. Relay RY1 will remain energized until the base voltage of relay driver transistor Q13 increases to the B+ voltage. The key also turns transistor Q11 on and off which switches the Transceiver between transmit and receive.

The B+ voltage at the relay is used to switch VFO offset diode D11 to provide offset during transmit and also to switch the mute transistor Q14 on. This effectively connects the input of the audio preamplifier stage to ground, thus muting the receiver during transmit.

When the key is released, the emitter and collector voltages of Q12 try to increase toward B+. However, at this time, capacitor C92 is discharging through delay control R68, which keeps the relay energized. After capacitor C92 has discharged and the voltage on the collector of Q13 returns to normal, the relay opens. The amount of time required for capacitor C92 to discharge is adjustable through delay control R68.

## RECEIVER CIRCUITS

The signals received by the antenna are coupled through RF Gain control R302 and through the appropriate front panel pushbutton switch (for example we will say the 3.5 MHz band switch). From here, the signal is coupled through coil L1 and diode D1 to RF amplifier Q1. Coil L1 and capacitors C1, C3, and C301A form a resonant circuit. Diode D1 provides the electrical switching to connect the signal to FET Q1 when the 3.5 MHz switch is depressed.

The signal is amplified by FET Q1 and is filtered by one of the coil-capacitor networks. (Each network serves as a filter for one of the four bands.) This filtered signal is then coupled through capacitor C25 to pin 1 of IC1, the balanced product detector. IC1 mixes the premixed VFO signal with the received signal to produce an audio signal. This signal is present at pin 9 of IC1 and is coupled through capacitors C33, C35, and resistor R19 to pin 3 of IC2A.

IC2A and IC2B are active audio filters. The audio signal passes through these two stages of audio filtering, which removes any RF signal and produces an audio signal that has good audio bandwidth and excellent skirt selectivity. There are two stages of audio selectivity which are selected by Selectivity switch SW302 on the front panel.

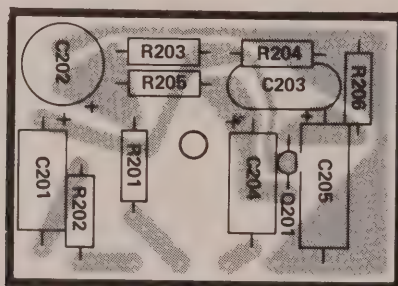
From the Selectivity switch, the signal is coupled through capacitor C38 to IC2C. IC2C is an audio preamplifier which amplifies the signal and then couples it through resistor R202 and capacitor C201 to transistor Q201. Transistor Q201 further amplifies the signal and then it is coupled through capacitor C204 to headphone jack J301.

# CIRCUIT BOARD

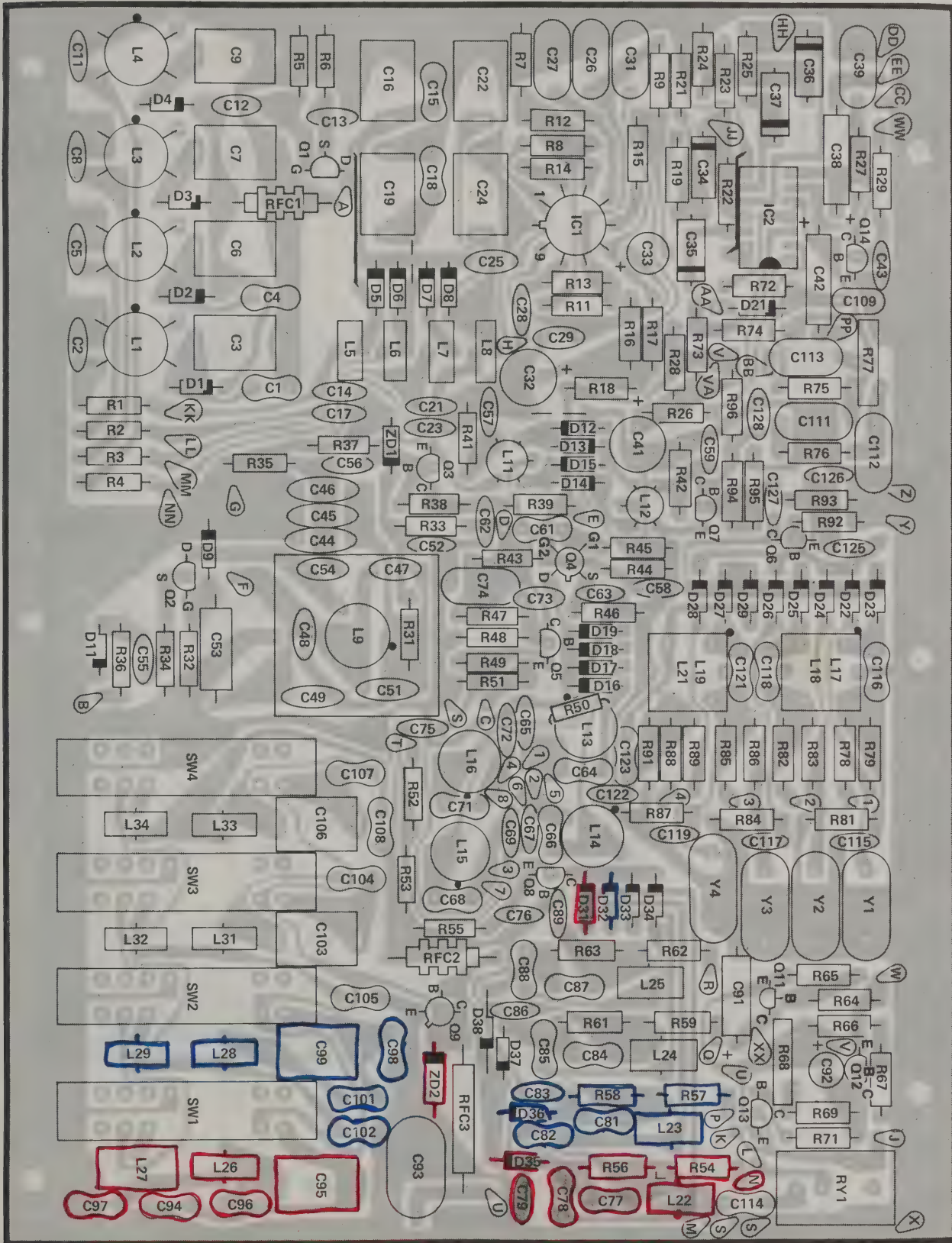
## X-RAY VIEWS

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

- A. Find the circuit component number (R5, C3, etc.) on the "Circuit Board X-Ray Views."
- B. Locate this same number in the "Circuit Component Number" column of the "Parts List" in the front of this Manual.
- C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



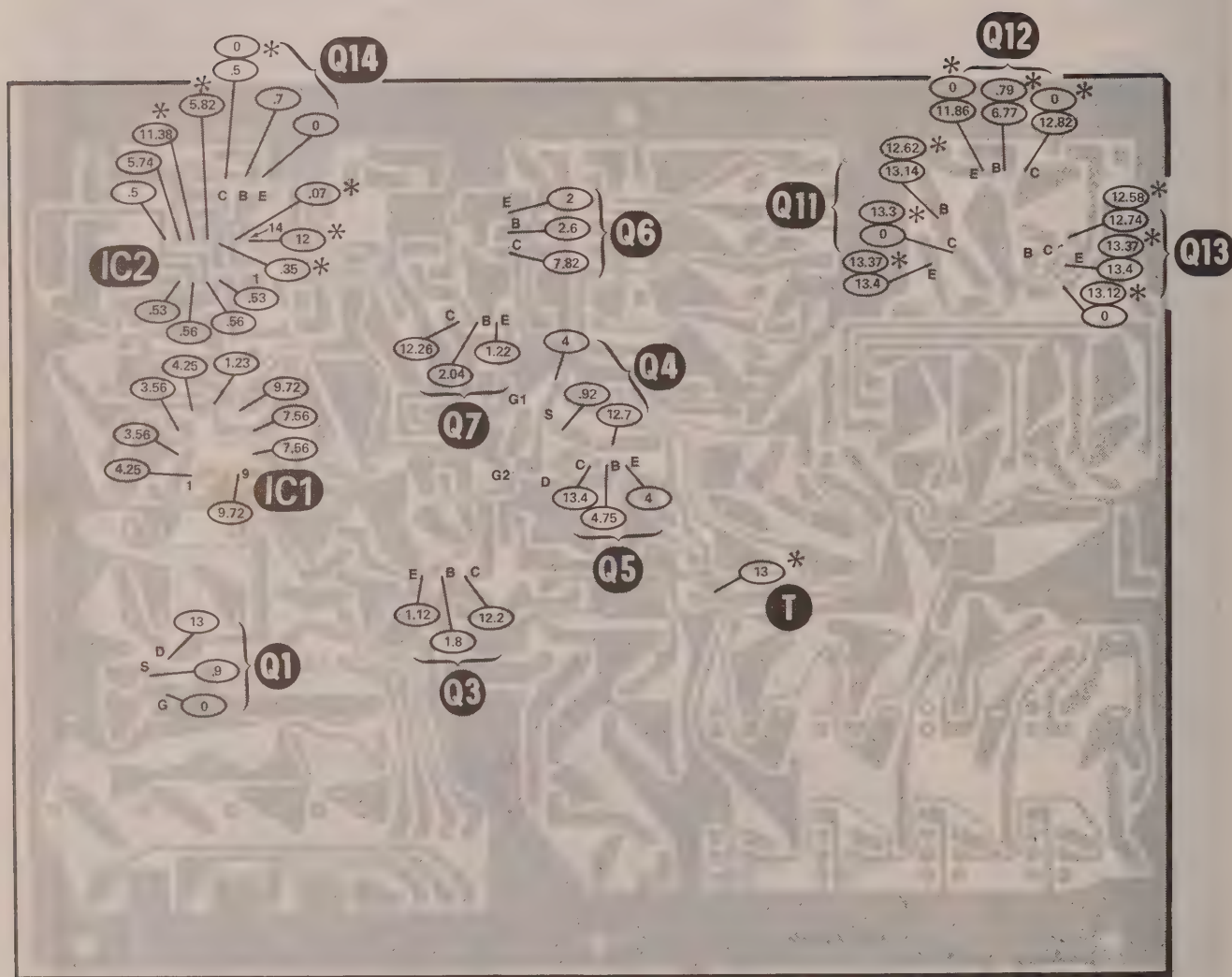
AF AMPLIFIER CIRCUIT BOARD  
(Viewed from foil side)



MAIN CIRCUIT BOARD  
(Viewed from foil side)

4.7K  
291 2000

# CIRCUIT BOARD VOLTAGE CHART



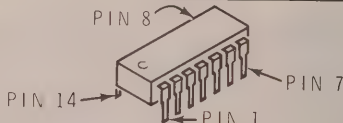

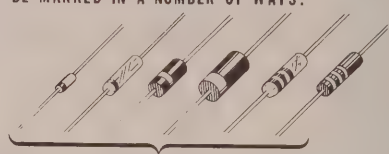
○ THIS SYMBOL INDICATES A RECEIVE-MODE DC VOLTAGE MEASURED FROM THE POINT INDICATED TO CHASSIS.

○\* THIS SYMBOL INDICATES A TRANSMIT-MODE DC VOLTAGE MEASURED FROM THE POINT INDICATED TO CHASSIS.

# IDENTIFICATION CHART

COMPONENT	HEATH PART NUMBER	TYPE NUMBER	IDENTIFICATION
Q13	417-201	X29A829	
Q1, Q2	417-169	MPF105	
Q11	417-116	S2091	
Q6, Q8	417-172	MPS-6521	
Q3, Q5, Q7, Q12, Q14, Q201	417-801	MPS-A20	
Q4	417-240	40673 <i>SK3065</i>	
Q9	417-880	2N4427 <i>27</i>	

## IDENTIFICATION CHART (Cont'd)

COMPONENT	HEATH PART NUMBER	TYPE NUMBER	IDENTIFICATION
IC2	442-71	LM3900	
IC1	442-96	MC1496	 (BOTTOM VIEW)
ZD1	56-19	VR-9.1	<p><b>IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.</b></p>  BANDED END
ZD2	56-55	VR-36	
D12, D13, D14, D15	56-87	FH100	
D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D16, D17, D18, D19, D21, D31, D32, D33, D34, D35, D36, D37, D38	56-24	1N458	
D22, D23, D24, D25, D26, D27, D28, D29,	56-56	1N4149	

330

230

130

0.1



15 METER

20 METER

40 METER

2

1

10

2

11

7

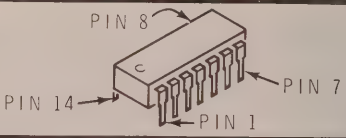
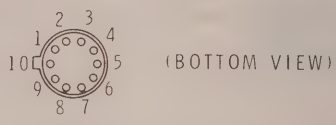
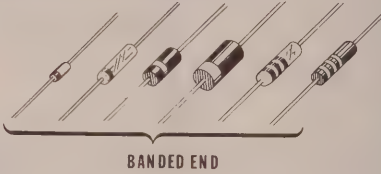
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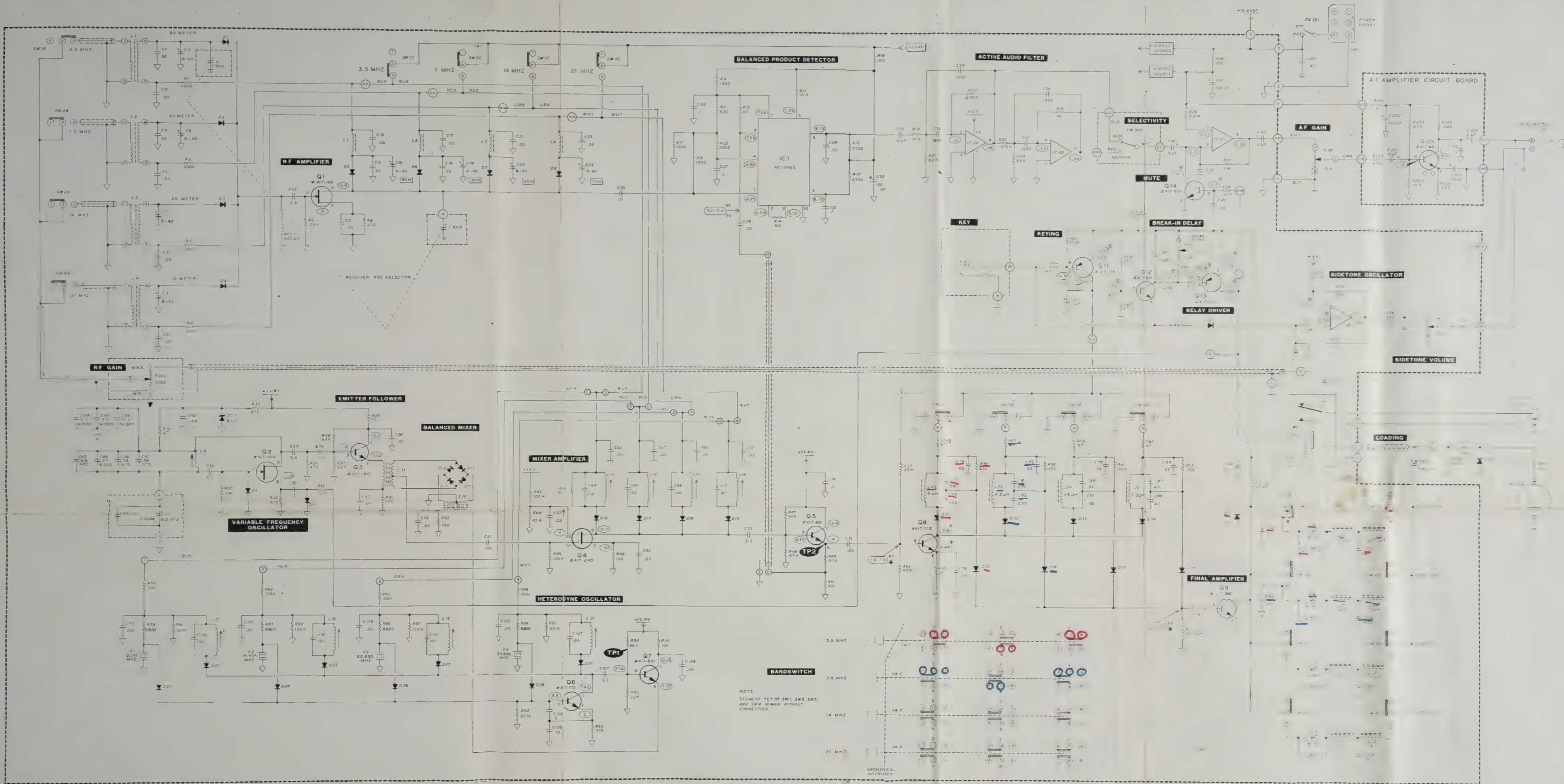
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## IDENTIFICATION CHART (Cont'd)

COMPONENT	HEATH PART NUMBER	TYPE NUMBER	IDENTIFICATION
IC2	442-71	LM3900	
IC1	442-96	MC1496	
ZD1	56-19	VR-9.1	<p><b>IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.</b></p>  <p style="text-align: center;">BANDED END</p>
ZD2	56-55	VR-36	
D12, D13, D14, D15	56-87	FH100	
D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D16, D17, D18, D19, D21, D31, D32, D33, D34, D35, D36, D37, D38	56-24	1N458	
D22, D23, D24, D25, D26, D27, D28, D29,	56-56	1N4149	



**SCHEMATIC OF THE  
HEATHKIT  
MODEL HW-8  
TRANSCIVER**

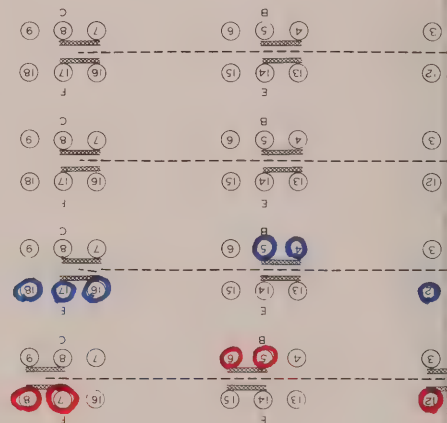
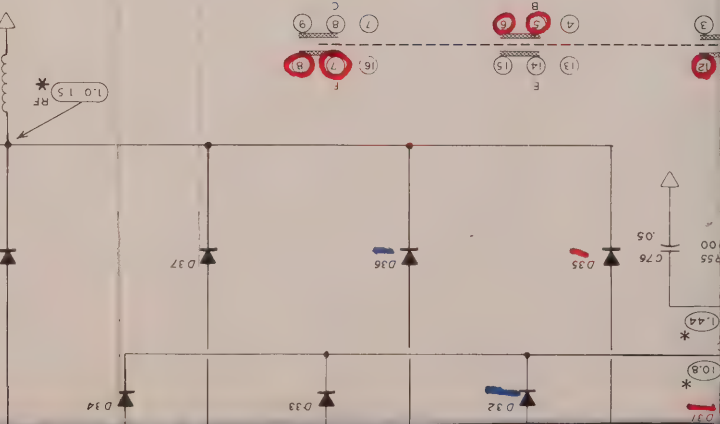
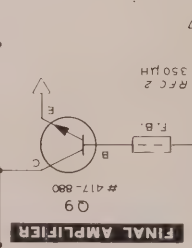
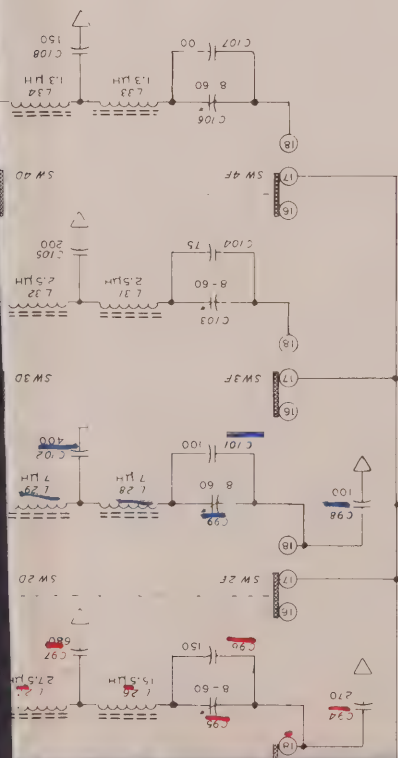
Copyright © 1975  
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All Rights Reserved  
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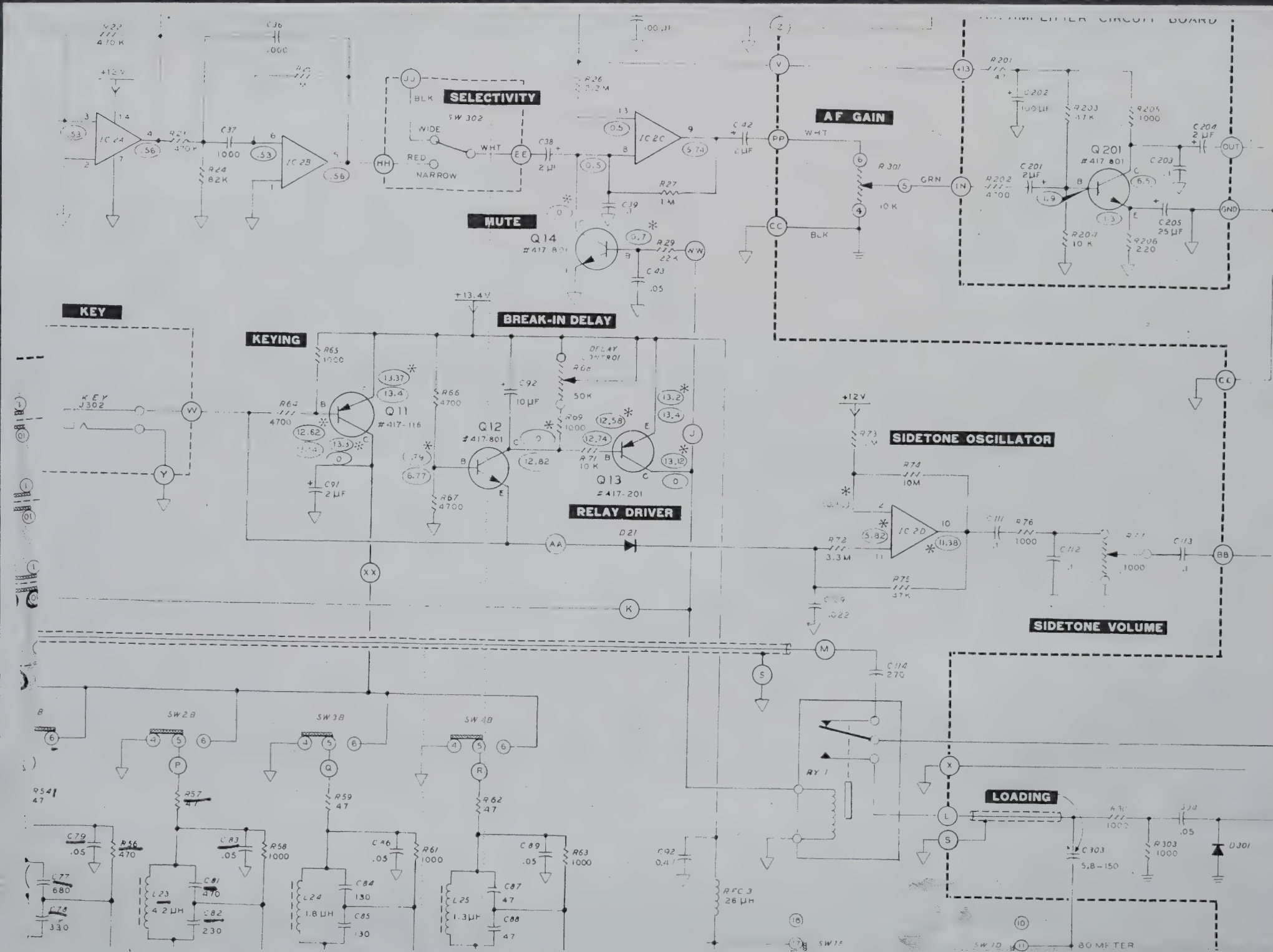
Part of 595-1754-09

1. CIRCUIT COMPONENT NUMBERS ARE IN THE FOLLOWING GROUPS:  
1 - 199 PARTS MOUNTED ON MAIN CIRCUIT BOARD.  
201 - 225 PARTS MOUNTED ON AF AMPLIFIER CIRCUIT BOARD.  
301 - 325 PARTS MOUNTED ON CHASSIS.

2. ALL RESISTOR VALUES ARE IN OHMS (K-1000, M-1,000,000).  
3. ALL CAPACITOR VALUES LESS THAN 1 ARE IN  $\mu$ F. VALUES OF 1 AND ABOVE ARE IN pF UNLESS OTHERWISE INDICATED.  
4. (TP) THIS SYMBOL INDICATES A TEST POINT.

5. THIS SYMBOL INDICATES A RECEIVE-MODE DC VOLTAGE MEASURED FROM THE POINT INDICATED TO CHASSIS.  
6. THIS SYMBOL INDICATES A TRANSMIT-MODE DC VOLTAGE MEASURED FROM THE POINT INDICATED TO CHASSIS.  
7. THIS SYMBOL INDICATES A RECEIVE-MODE RF VOLTAGE MEASURED USING AN RF PROBE CONNECTED BETWEEN THE POINT INDICATED AND CHASSIS.  
8. THIS SYMBOL INDICATES A TRANSMIT-MODE RF VOLTAGE MEASURED USING AN RF PROBE CONNECTED BETWEEN THE POINT INDICATED AND CHASSIS.  
9. ALL VOLTAGES MEASURED WITH A HIGH INPUT IMPEDANCE VOLTMETER. VOLTAGES MAY VARY  $\pm 20\%$ .  
10. ALL MEASUREMENTS OBTAINED USING A POWER SOURCE OF 13 VDC.  
11. BANDSWITCH SHOWN WITH 3.5 MHz PUSHBUTTON PRESSED IN AND TRANSCIVER OPERATING IN RECEIVE MODE.







# CUSTOMER SERVICE

## REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

## ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company  
Benton Harbor  
MI 49022  
Attn: Parts Replacement

**Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.**

## OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

## TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

**Please do not send parts for testing**, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

## REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

**If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.**

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least **THREE INCHES** of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company  
Service Department  
Benton Harbor, Michigan 49022

HEATH

Schlumberger

HEATH COMPANY • BENTON HARBOR, MICHIGAN  
***THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM***

LITHO IN U.S.A.



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***THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM***

LITHO IN U.S.A.

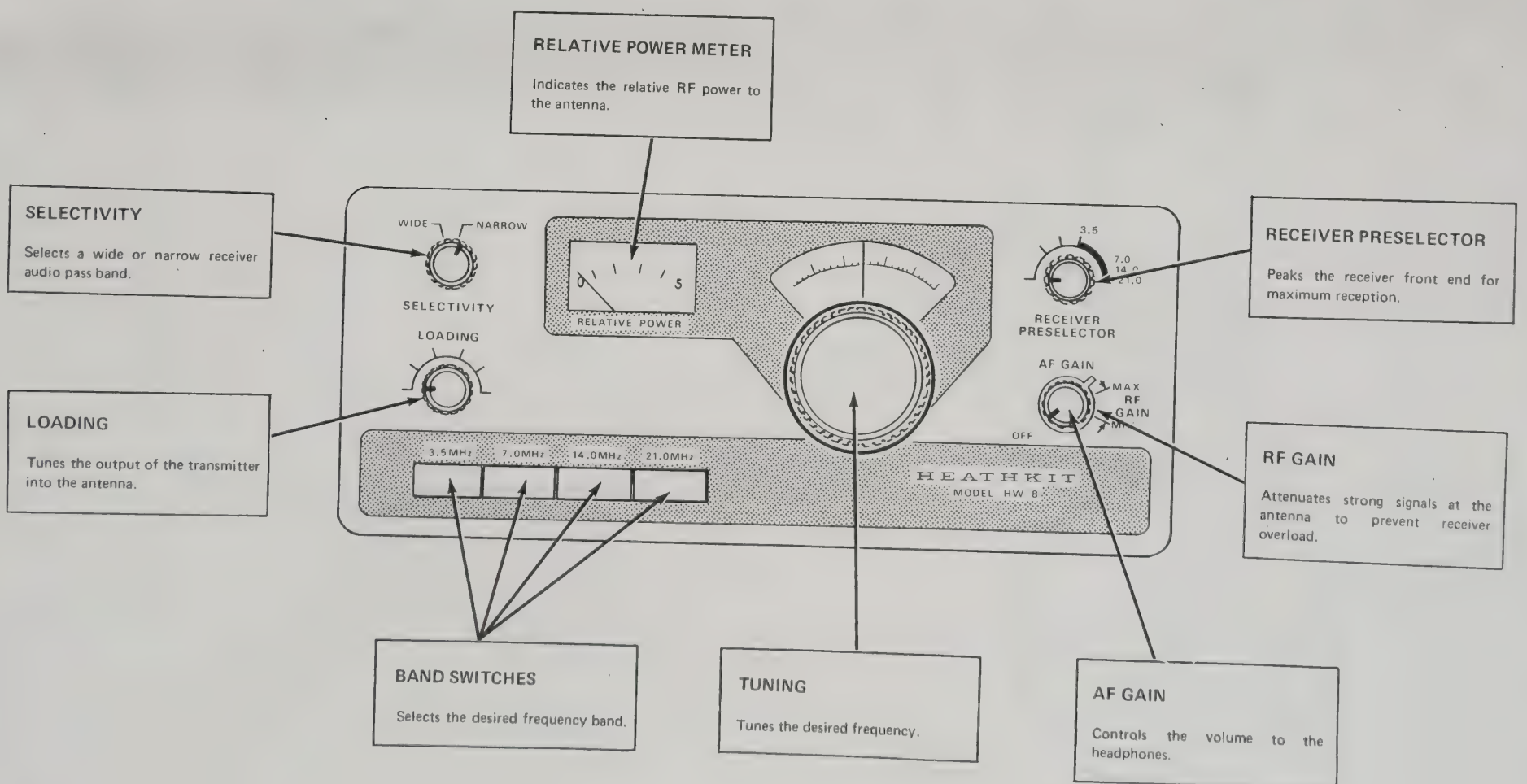
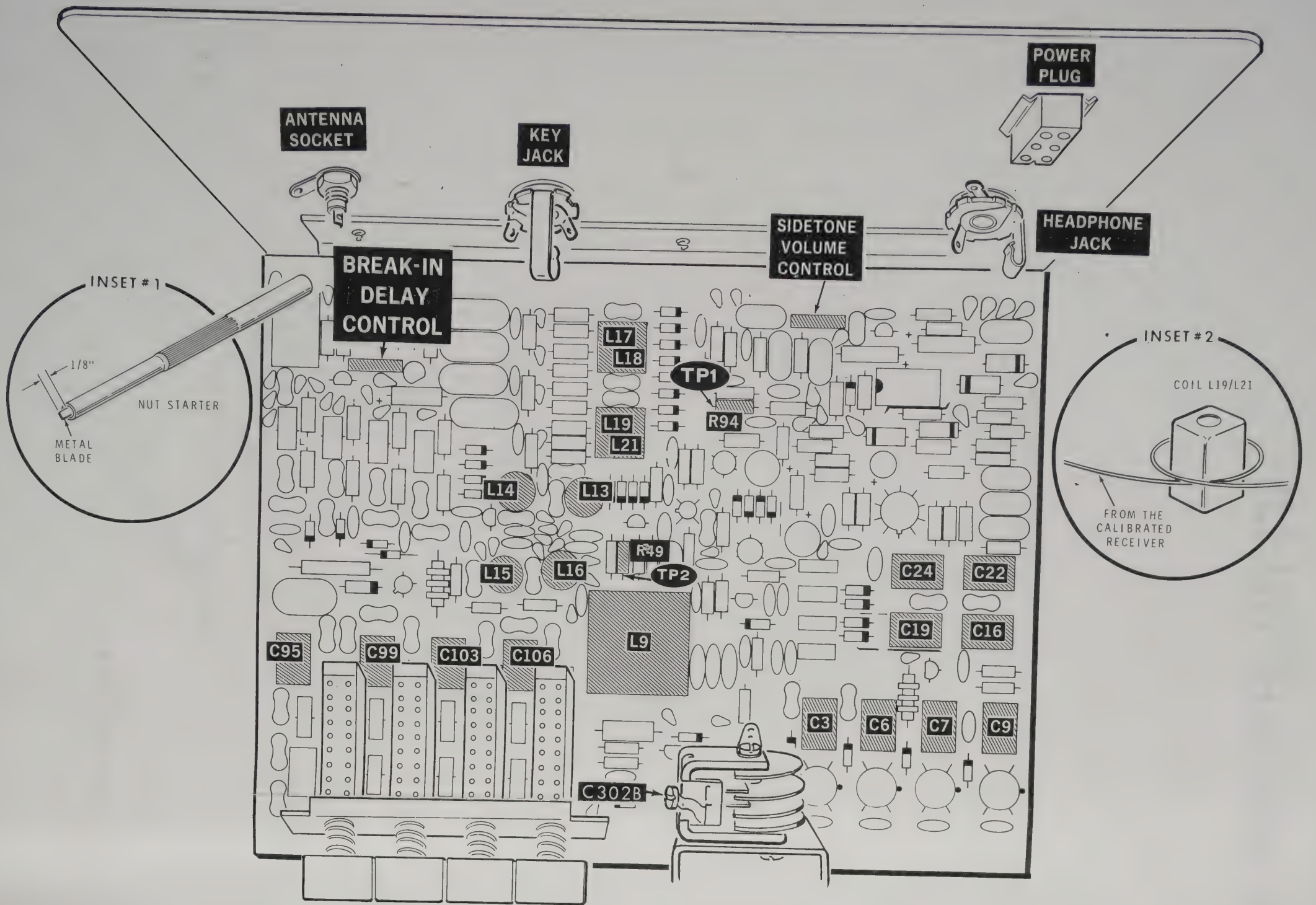
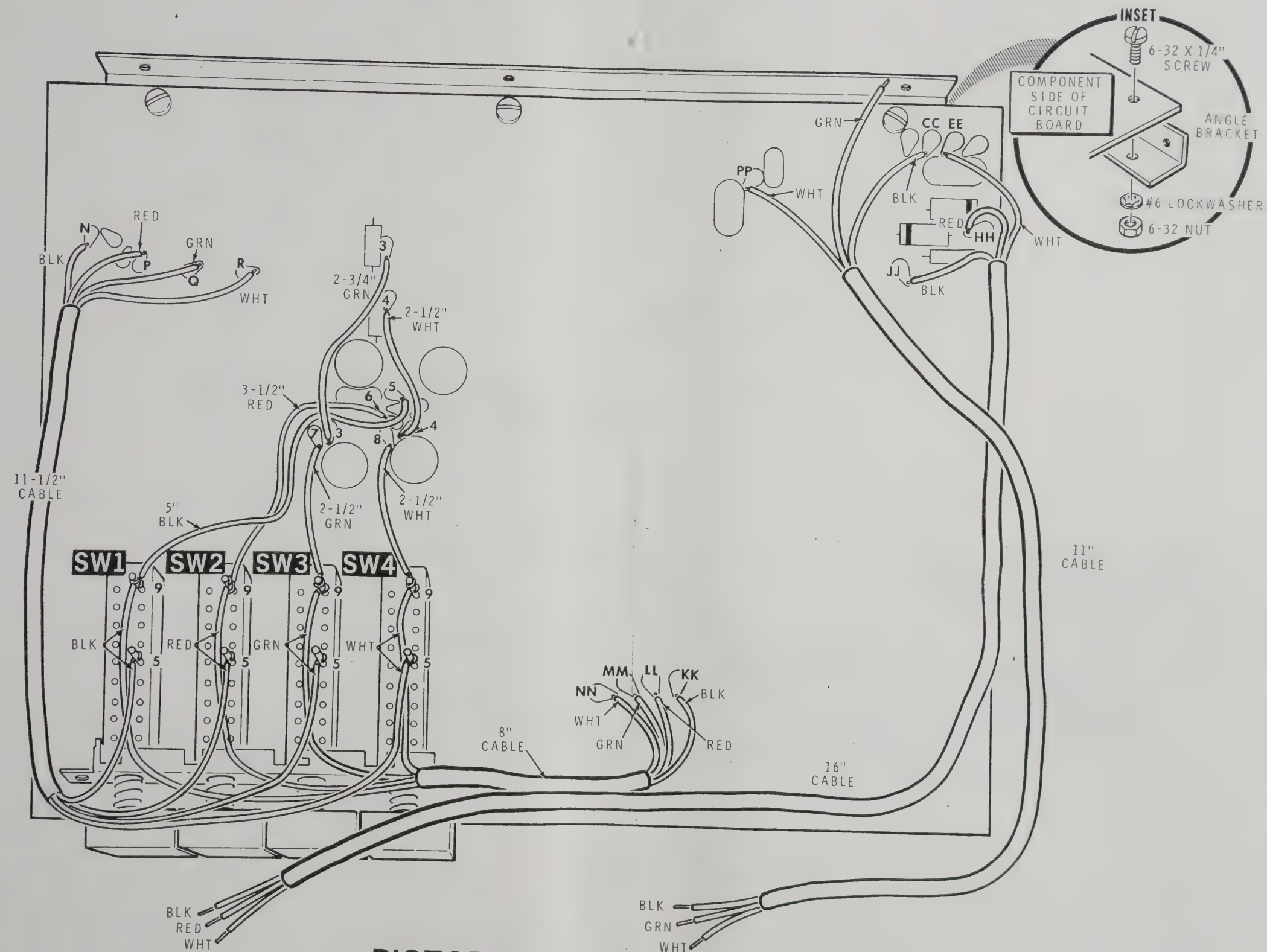


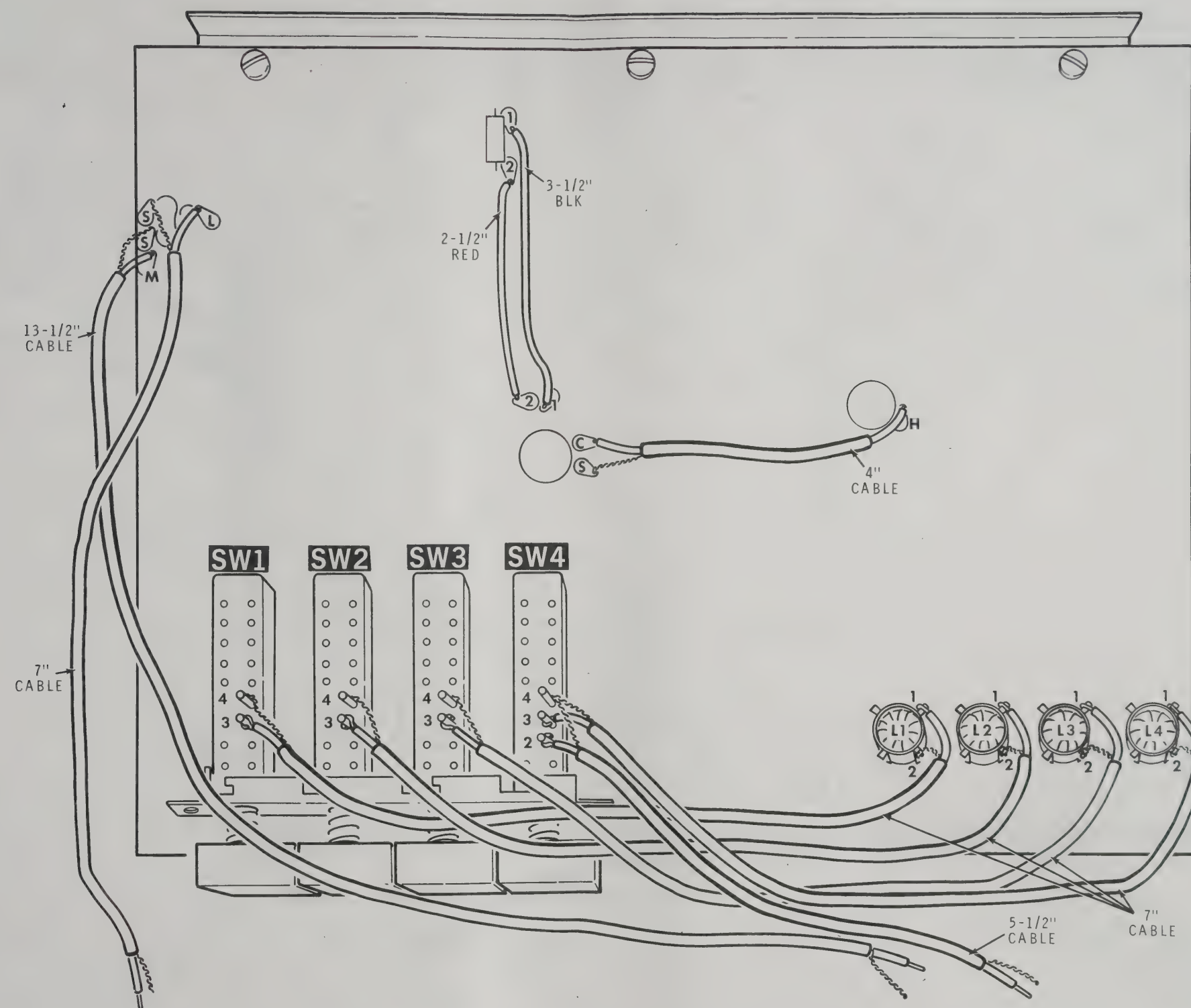
Figure 1-2

# ILLUSTRATION BOOKLET

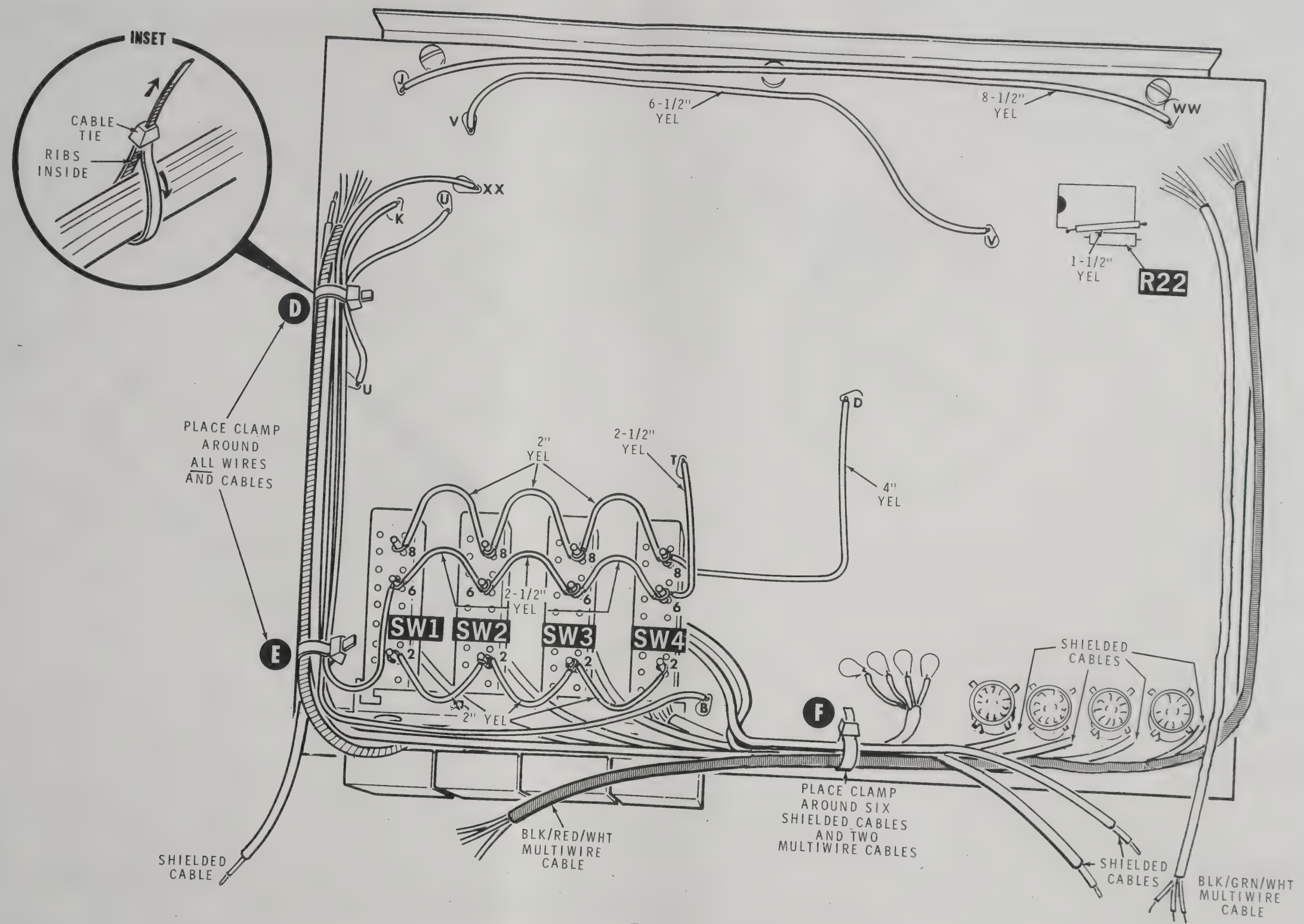
Part of 595-1754-09



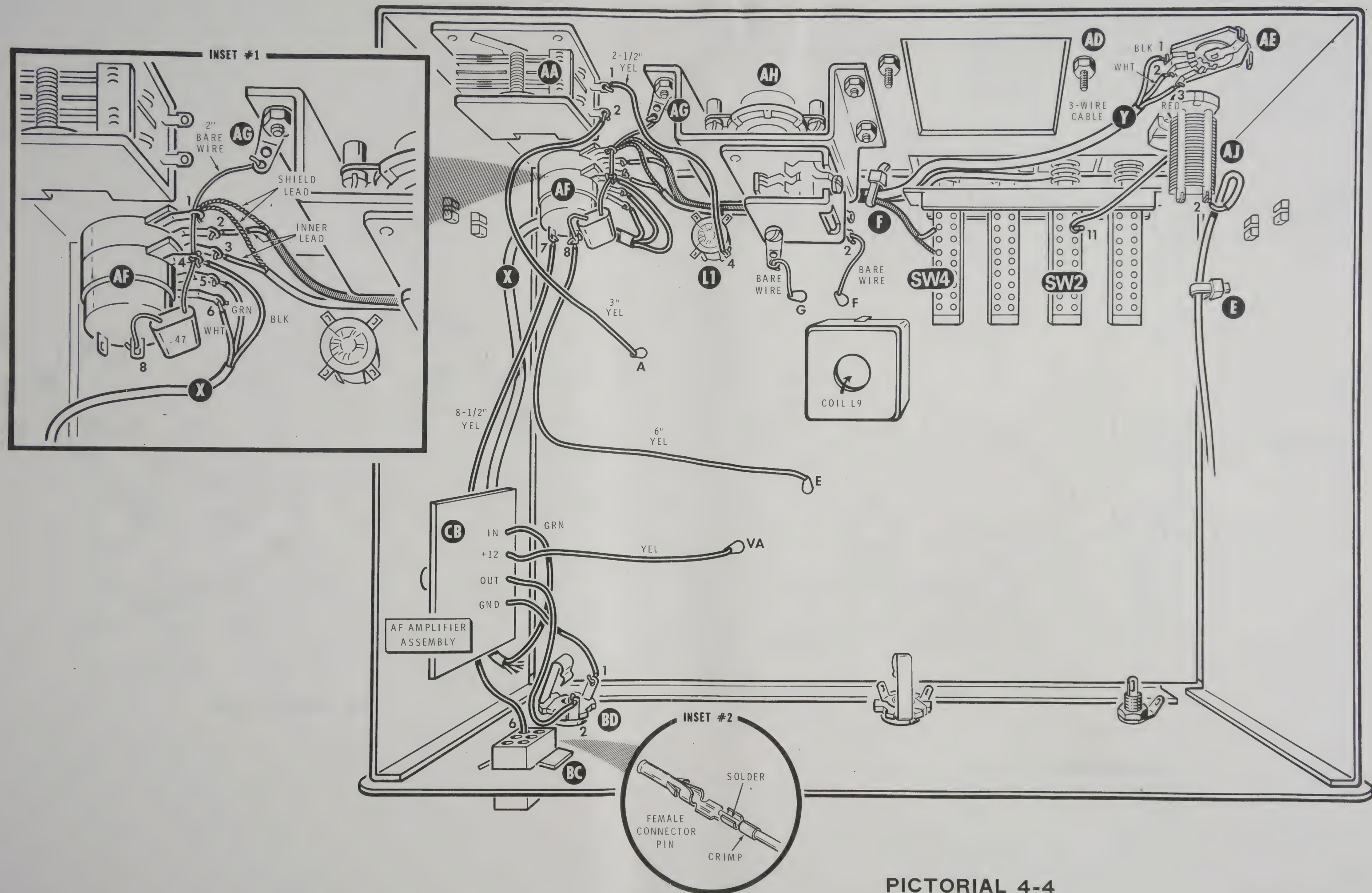
PICTORIAL 3-1

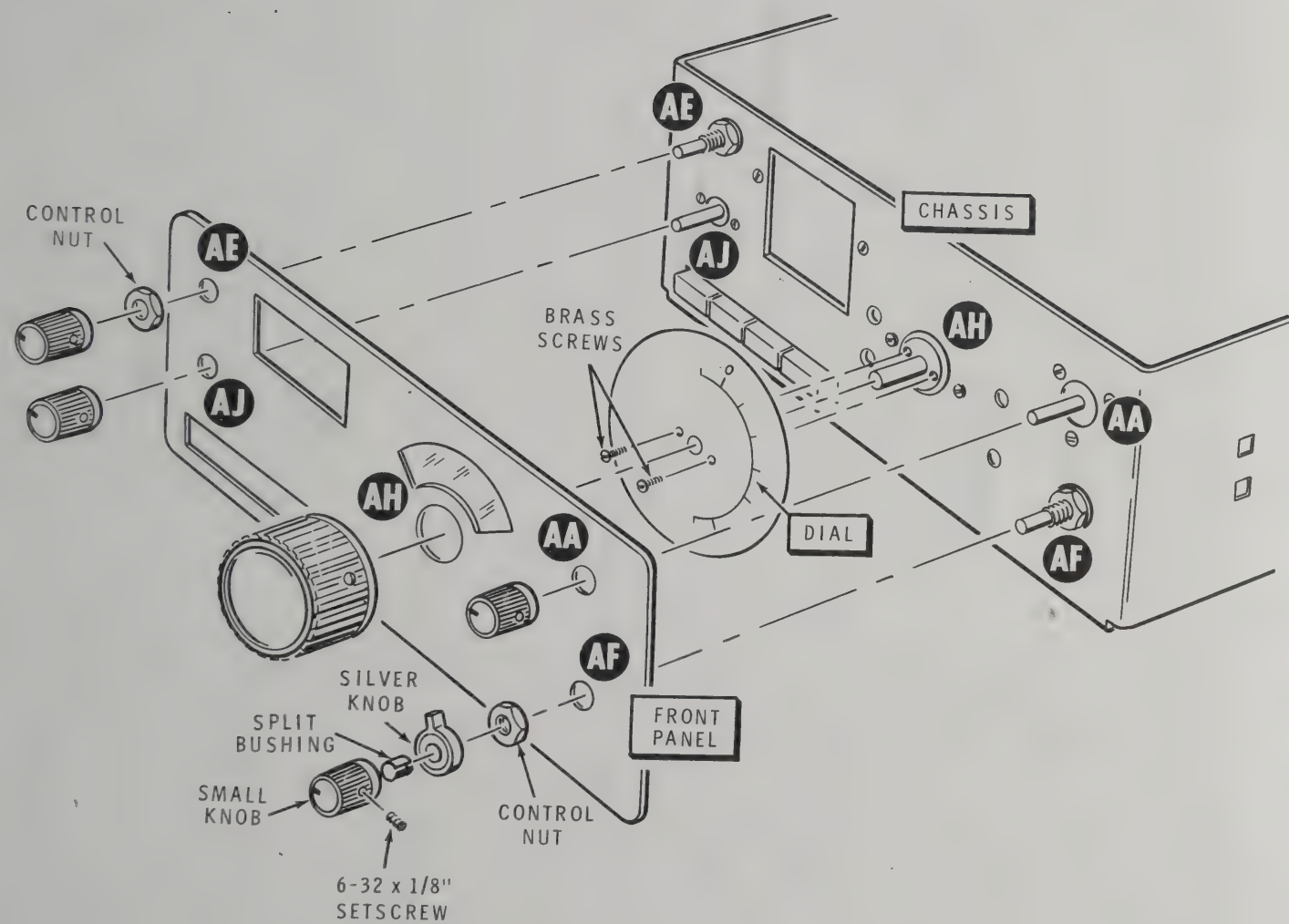


PICTORIAL 3-2

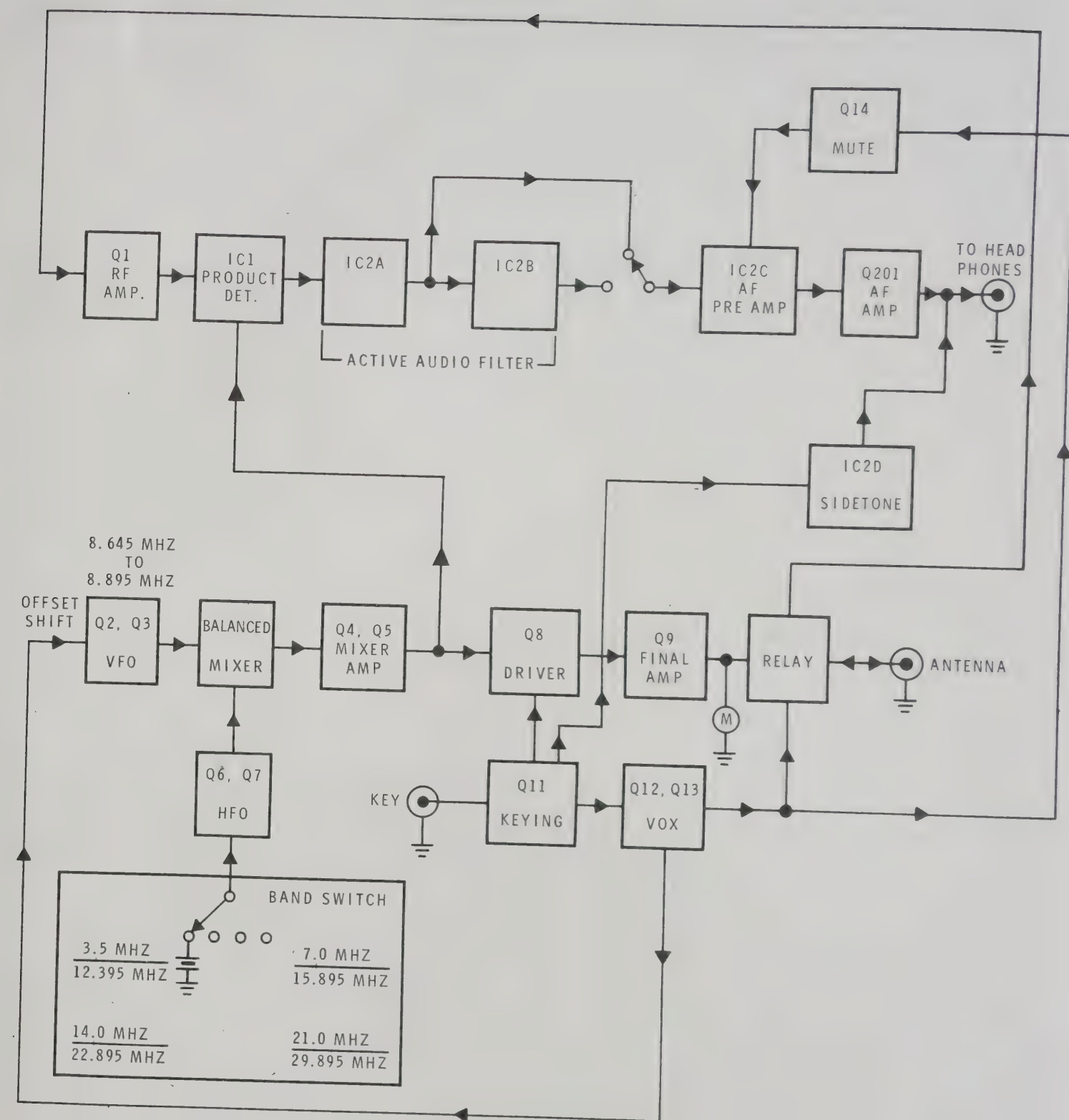


PICTORIAL 3-3

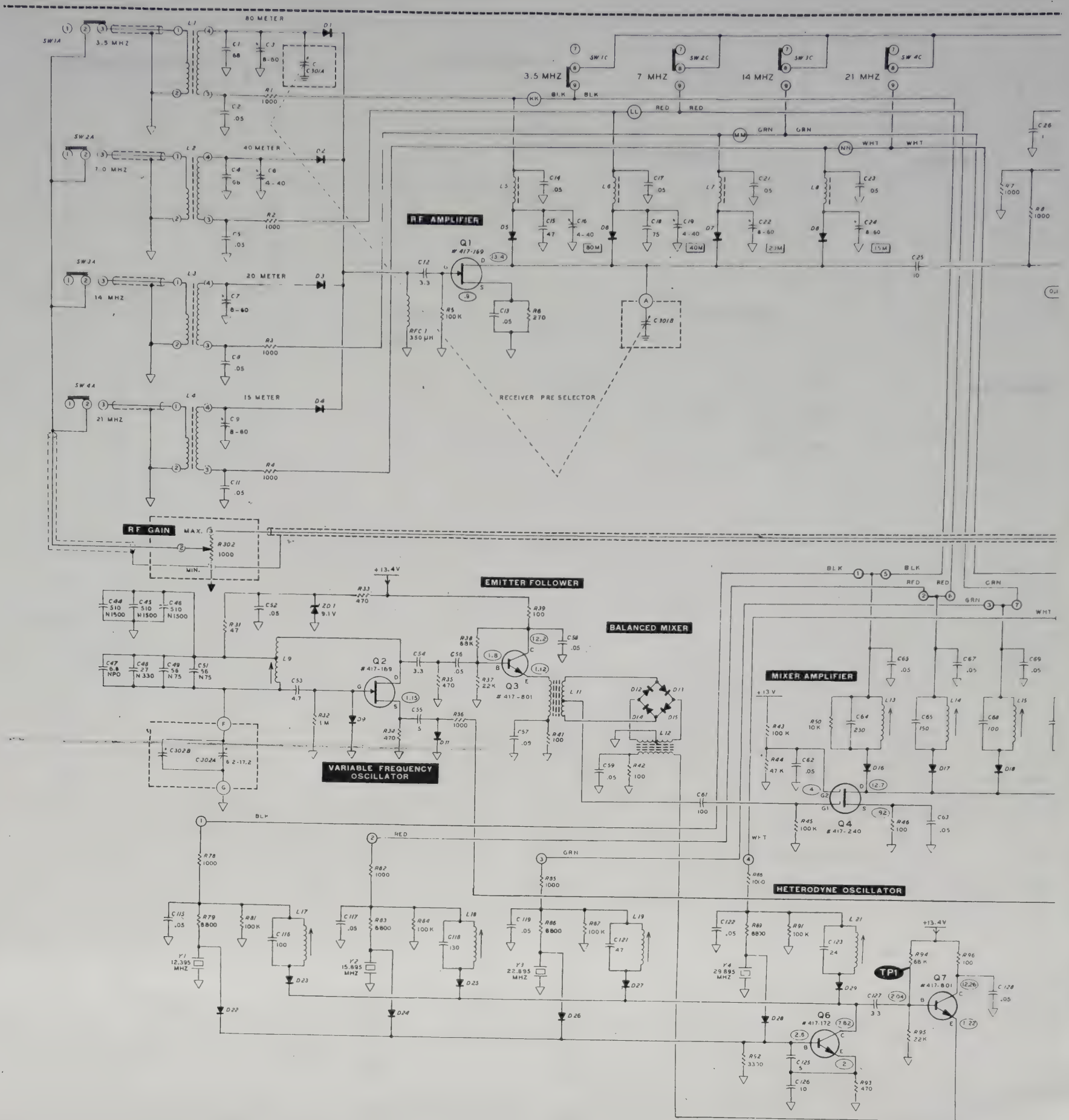




PICTORIAL 4-5



BLOCK DIAGRAM



# **SCHEMATIC OF THE HEATHKIT<sup>®</sup> MODEL HW-8 TRANSCIVER**

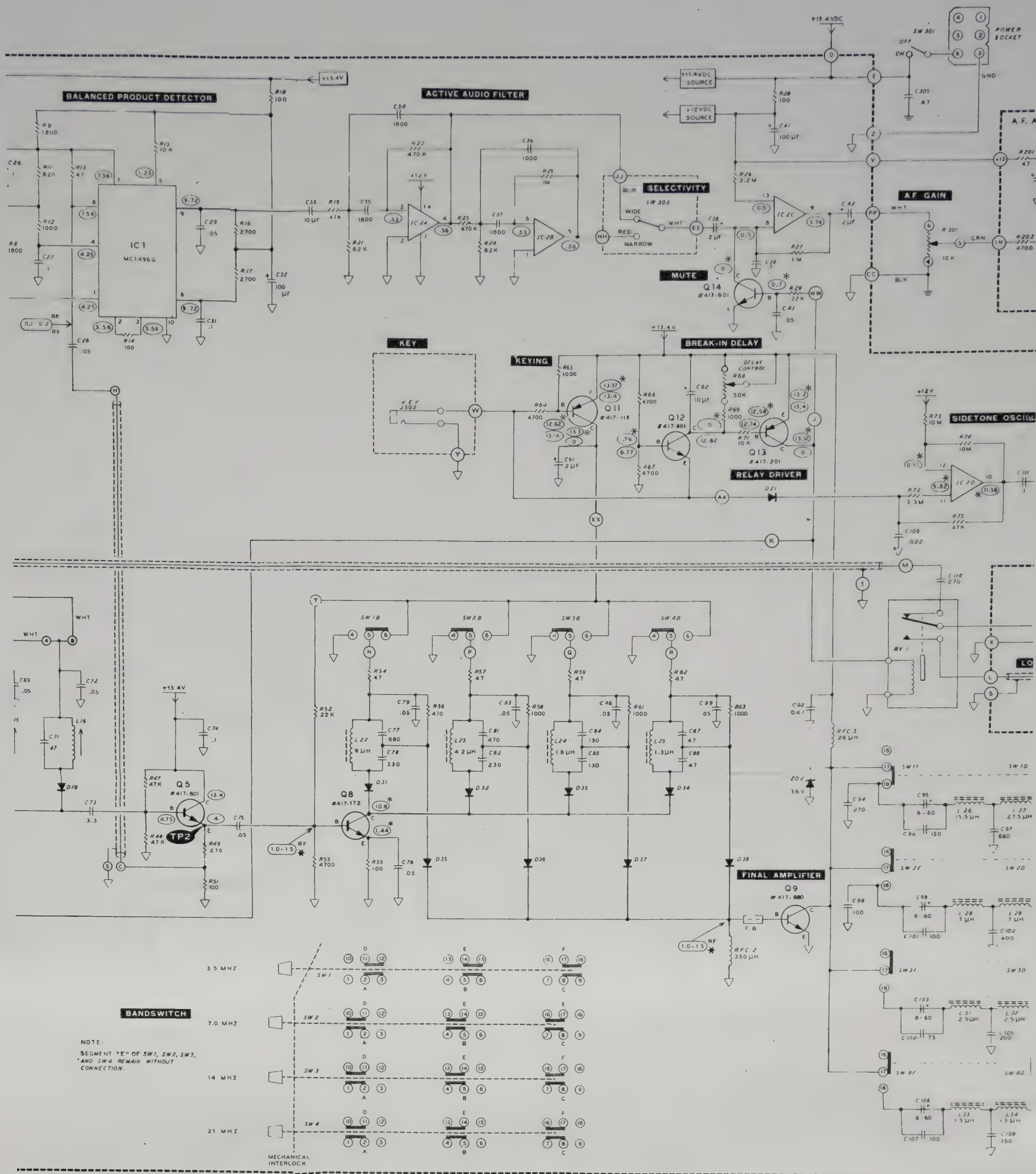
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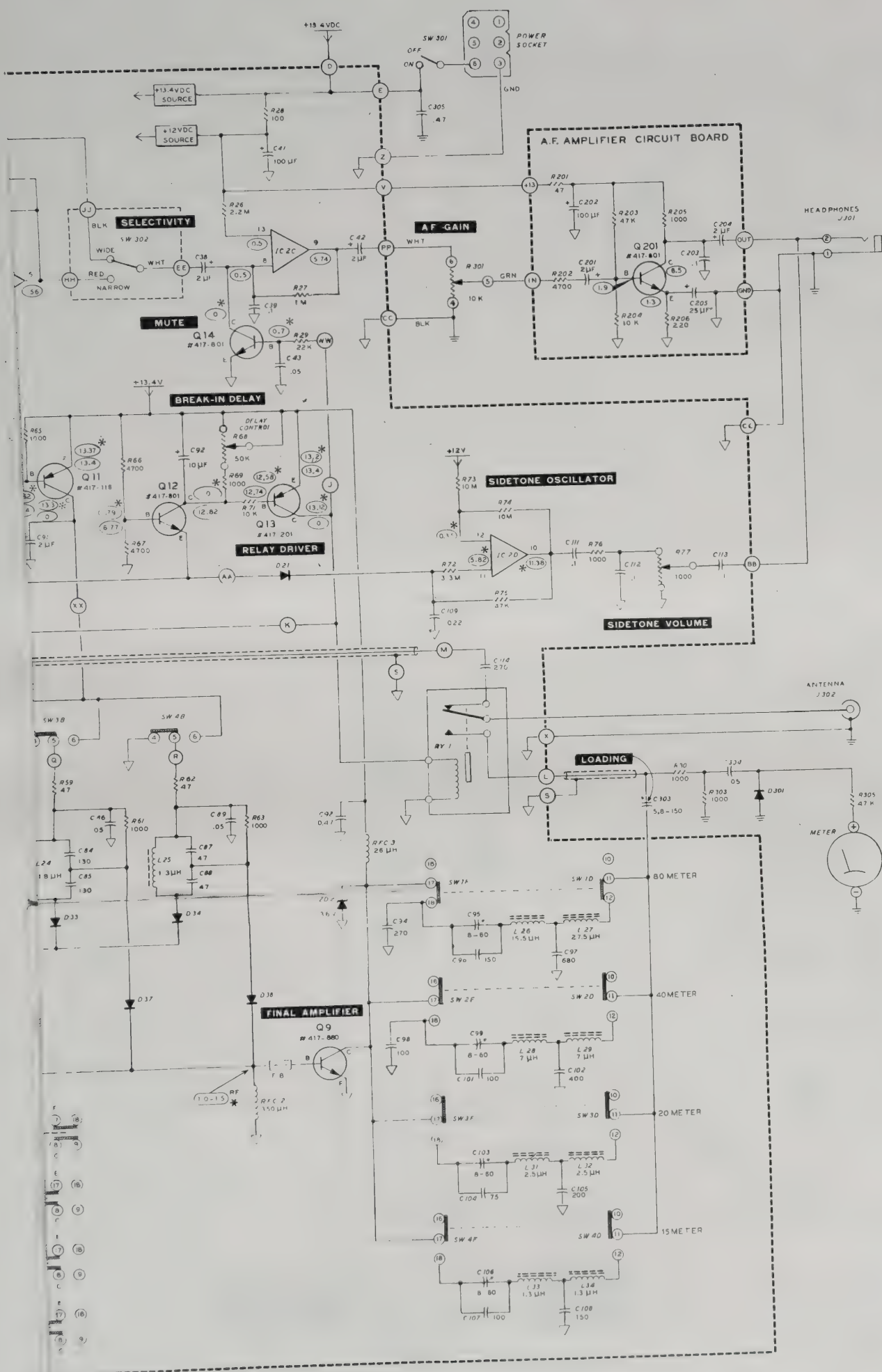
Part of I-595-1754-07

## **NOTES:**

1. CIRCUIT COMPONENT NUMBERS ARE IN THE FOLLOWING GROUPS:  
1 - 199 PARTS MOUNTED ON MAIN CIRCUIT BOARD.  
201 - 225 PARTS MOUNTED ON AF AMPLIFIER CIRCUIT BOARD.  
301 - 325 PARTS MOUNTED ON CHASSIS.
2. ALL RESISTOR VALUES ARE IN OHMS (K=1,000; M=1,000,000).
3. ALL CAPACITOR VALUES LESS THAN 1 ARE IN  $\mu$ F. VALUES OF 1 AND ABOVE ARE IN P.F. UNLESS OTHERWISE INDICATED.
4. (TP) THIS SYMBOL INDICATES A TEST POINT

5. THIS SYMBOL INDICATES A RECEIVE-MODE DC VOLTAGE MEASURED FROM THE POINT INDICATED TO CHASSIS
6. THIS SYMBOL INDICATES A TRANSMIT-MODE DC VOLTAGE MEASURED FROM THE POINT INDICATED TO CHASSIS
7. THIS SYMBOL INDICATES A RECEIVE-MODE RF VOLTAGE MEASURED USING AN RF PROBE CONNECTED BETWEEN THE POINT INDICATED AND CHASSIS.
8. THIS SYMBOL INDICATES A TRANSMIT-MODE RF VOLTAGE MEASURED USING AN RF PROBE CONNECTED BETWEEN THE POINT INDICATED AND CHASSIS.
9. ALL VOLTAGES MEASURED WITH A HIGH INPUT IMPEDANCE VOLTMETER. VOLTAGES MAY VARY  $\pm 20\%$ .
10. ALL MEASUREMENTS OBTAINED USING A POWER SOURCE OF 13 VDC.
11. BANDSWITCH SHOWN WITH 3.5 MHz PUSHBUTTON PRESSED IN AND TRANSCIVER OPERATING IN RECEIVE MODE.





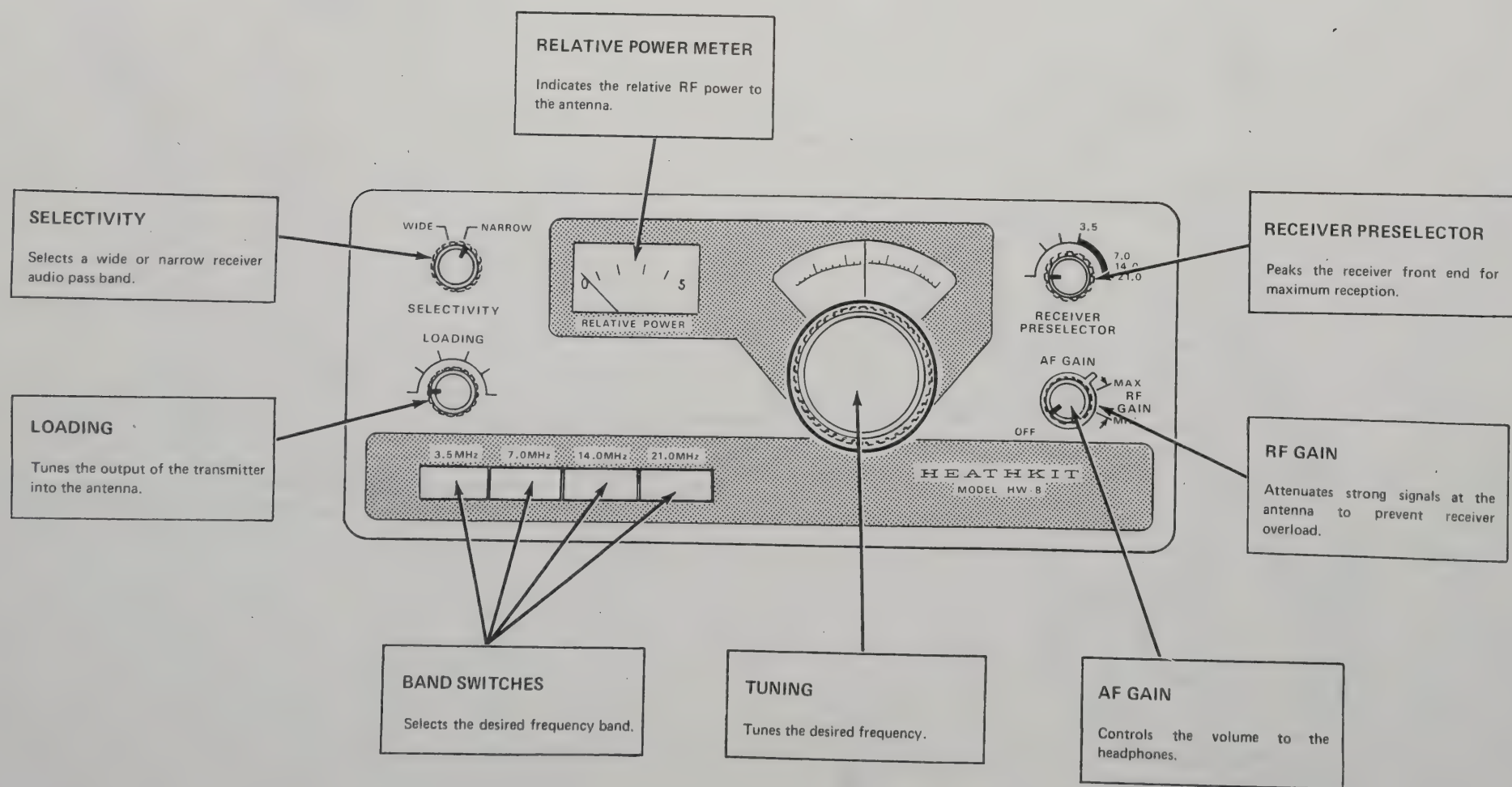
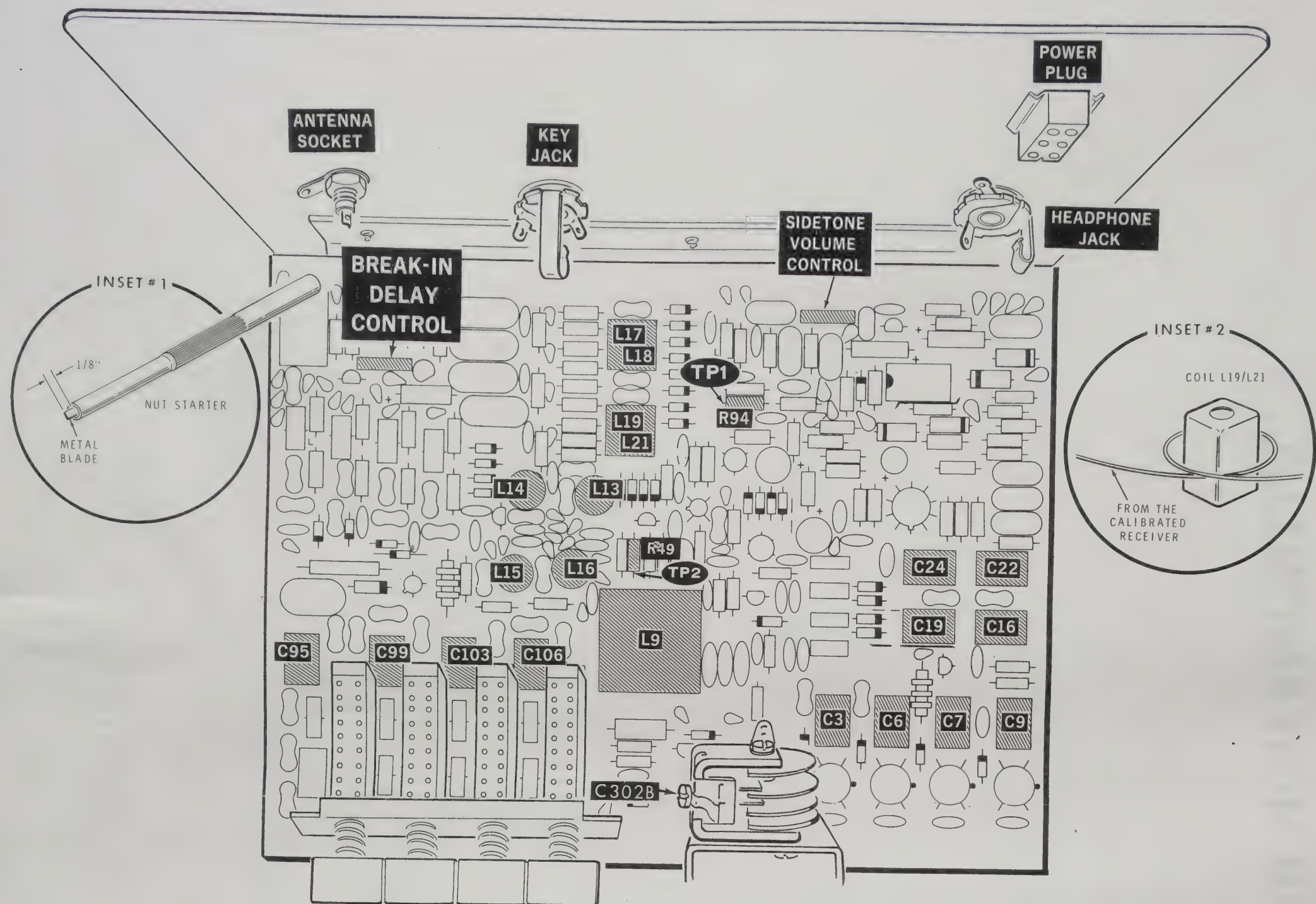
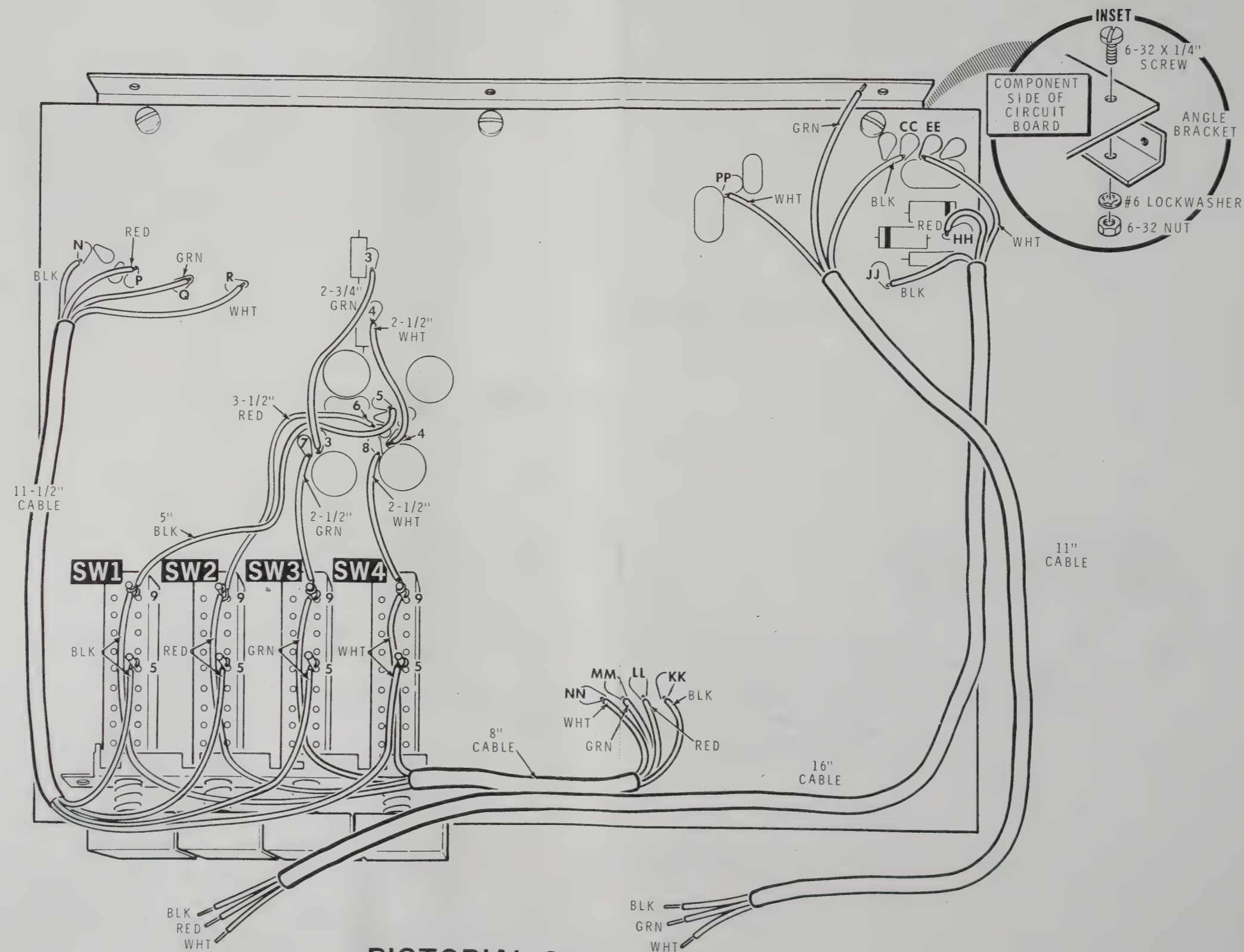


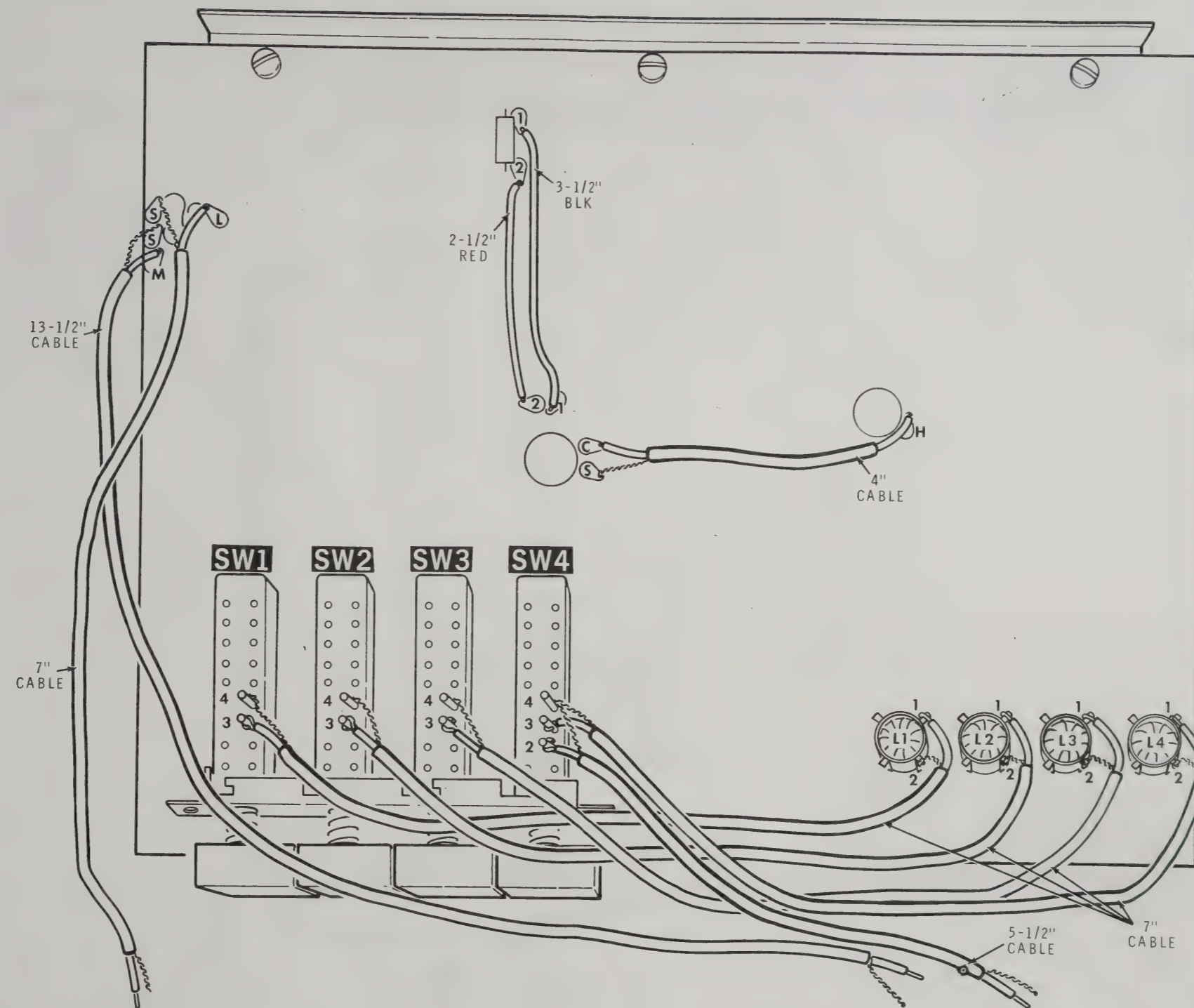
Figure 1-2

# ILLUSTRATION BOOKLET

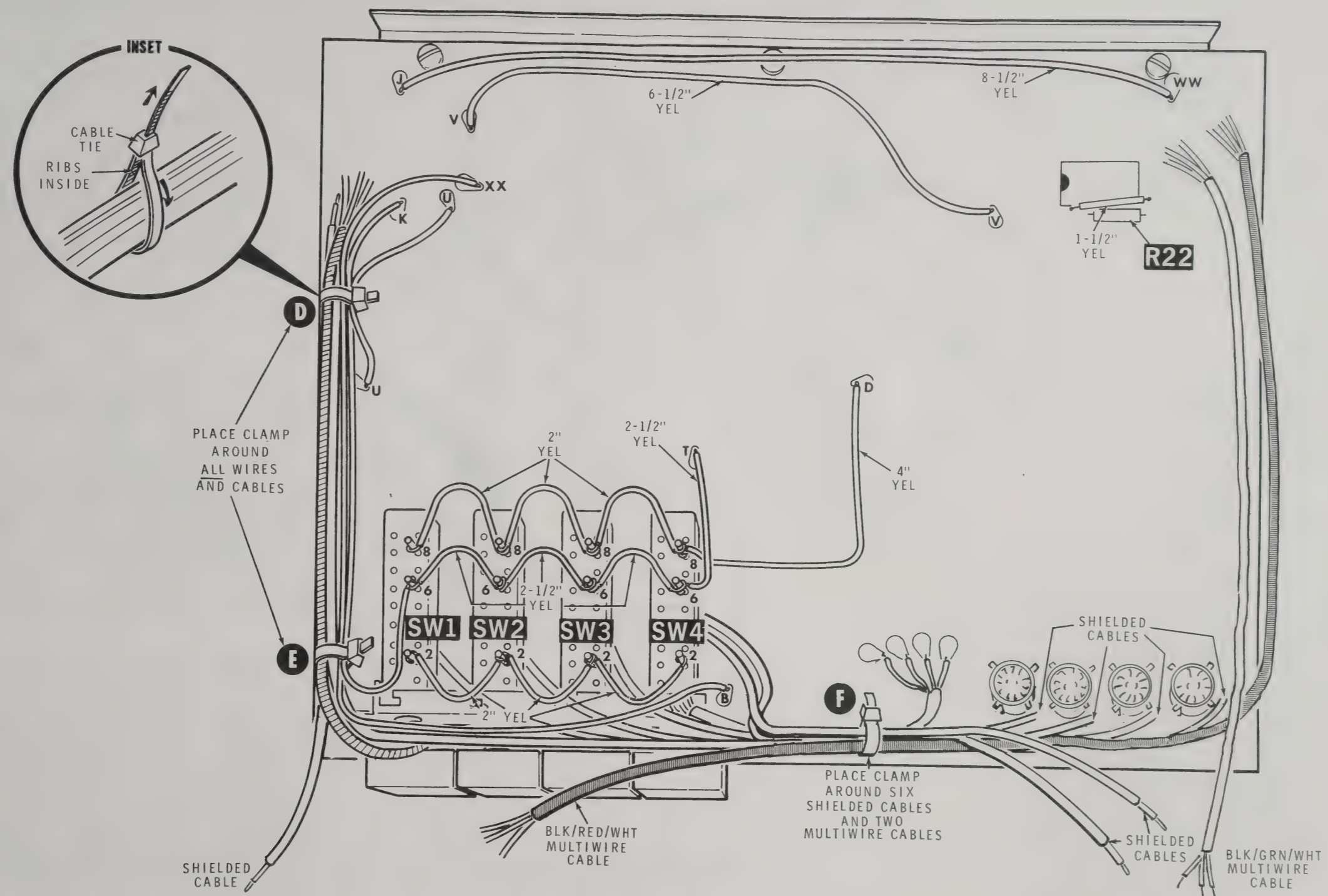
Part of 595-1754-09



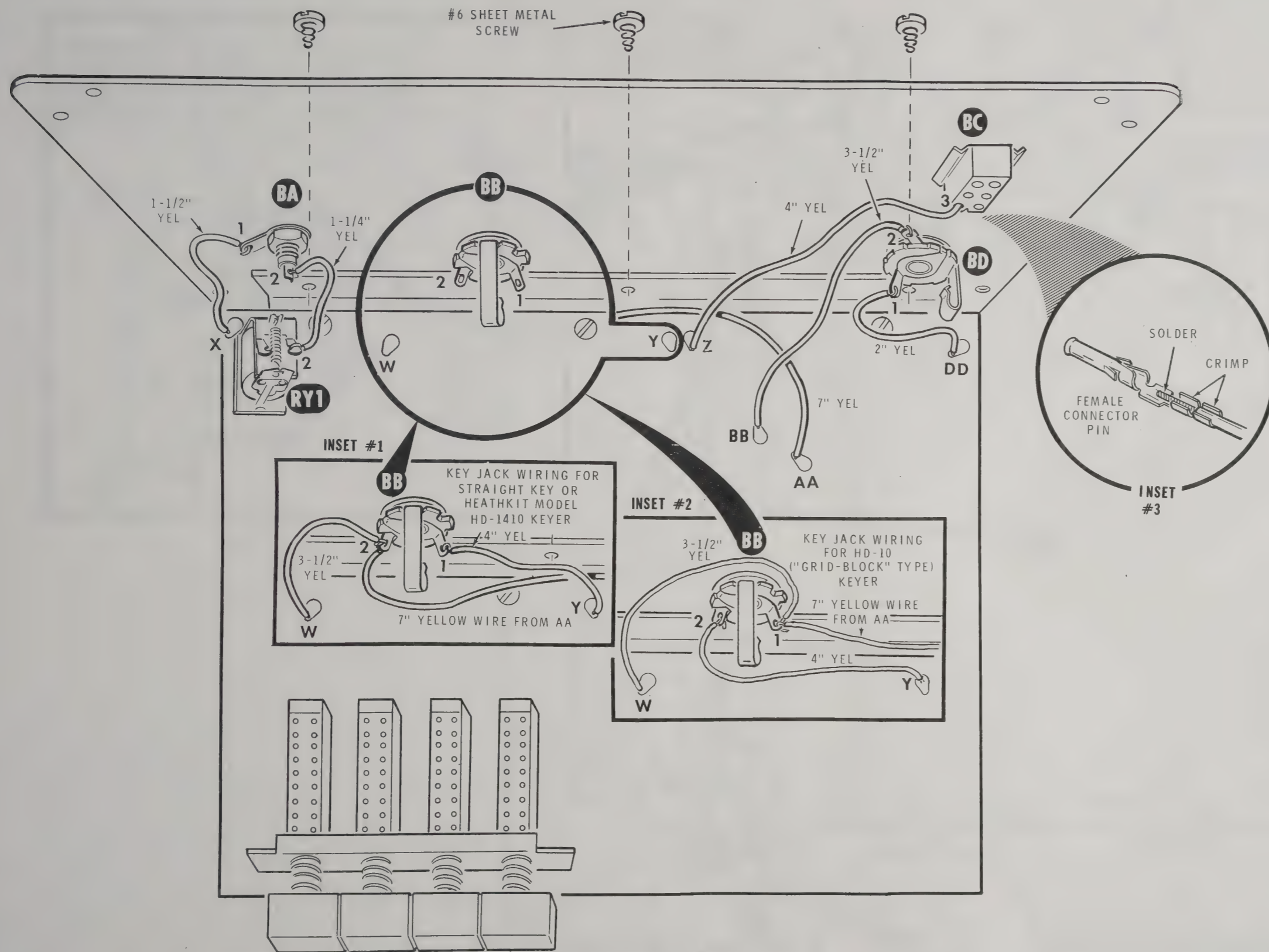
PICTORIAL 3-1



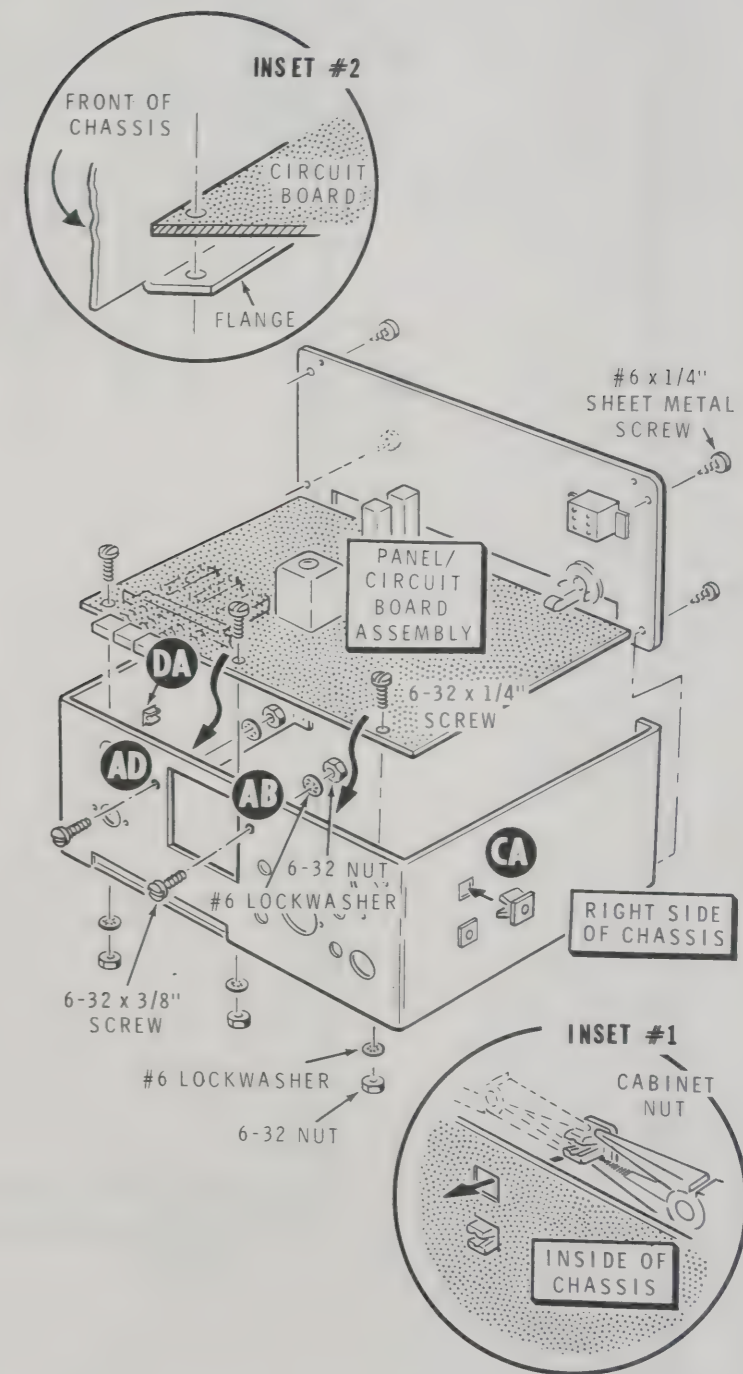
PICTORIAL 3-2



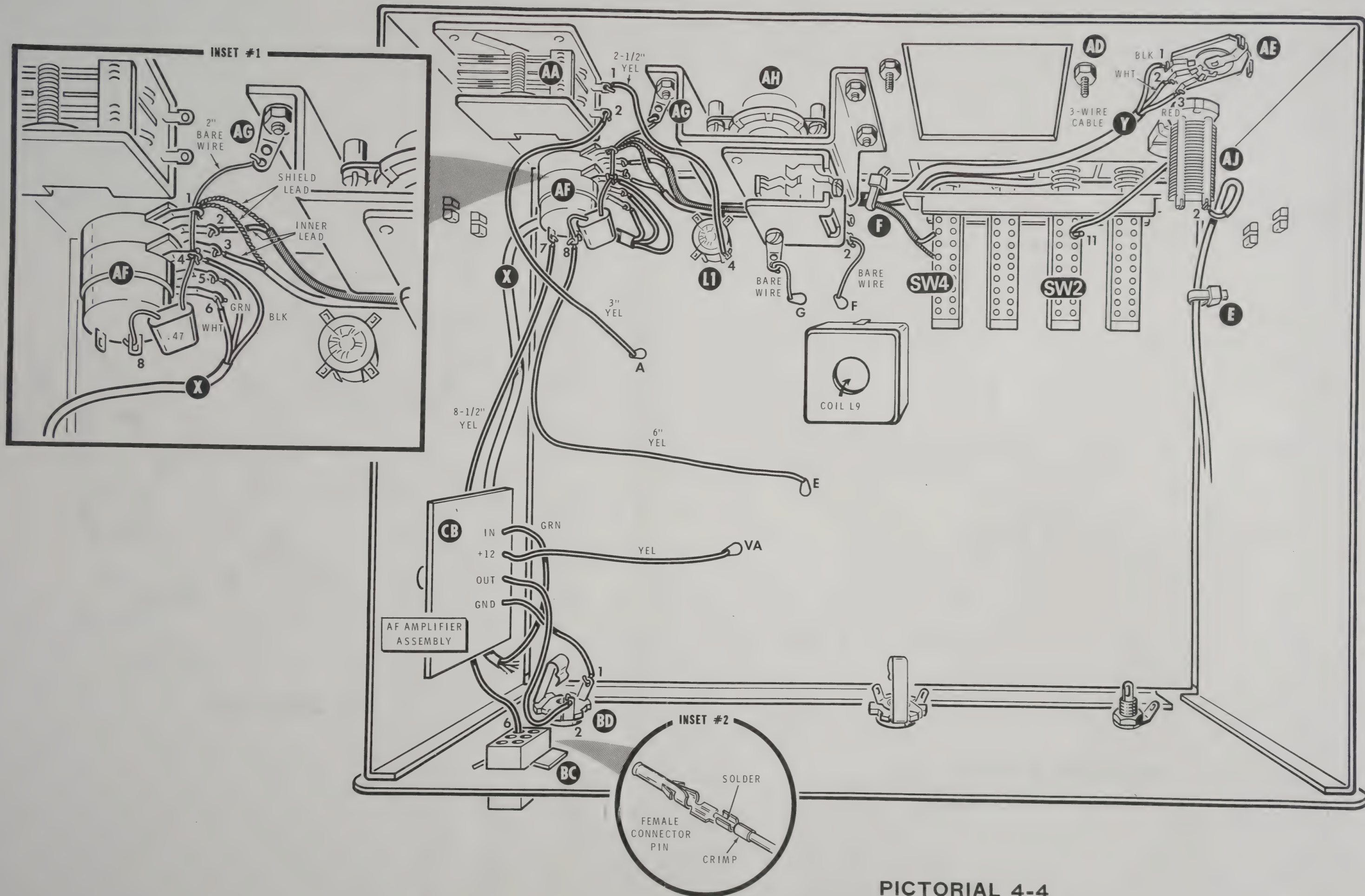
PICTORIAL 3-3

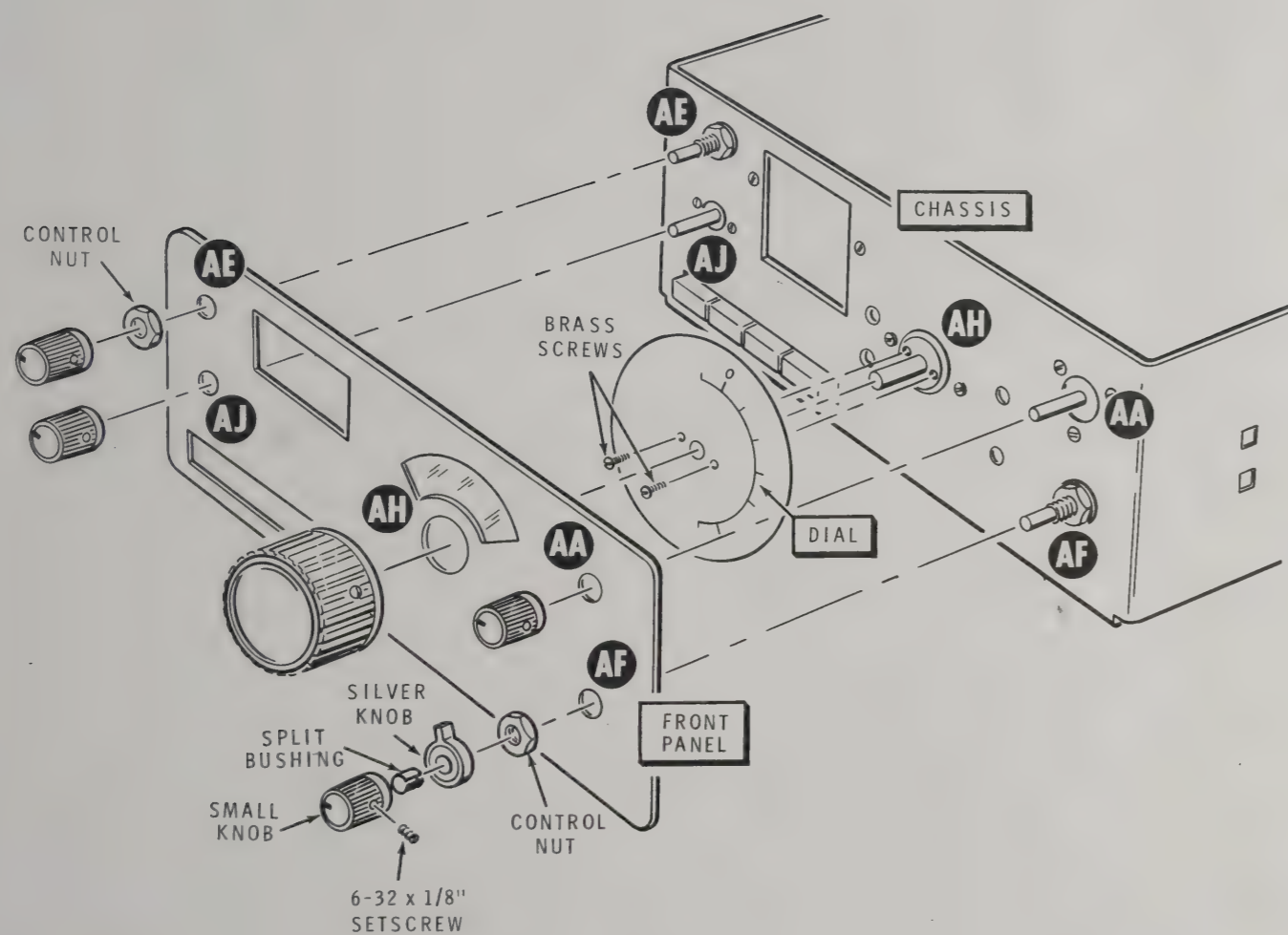


PICTORIAL 4-2

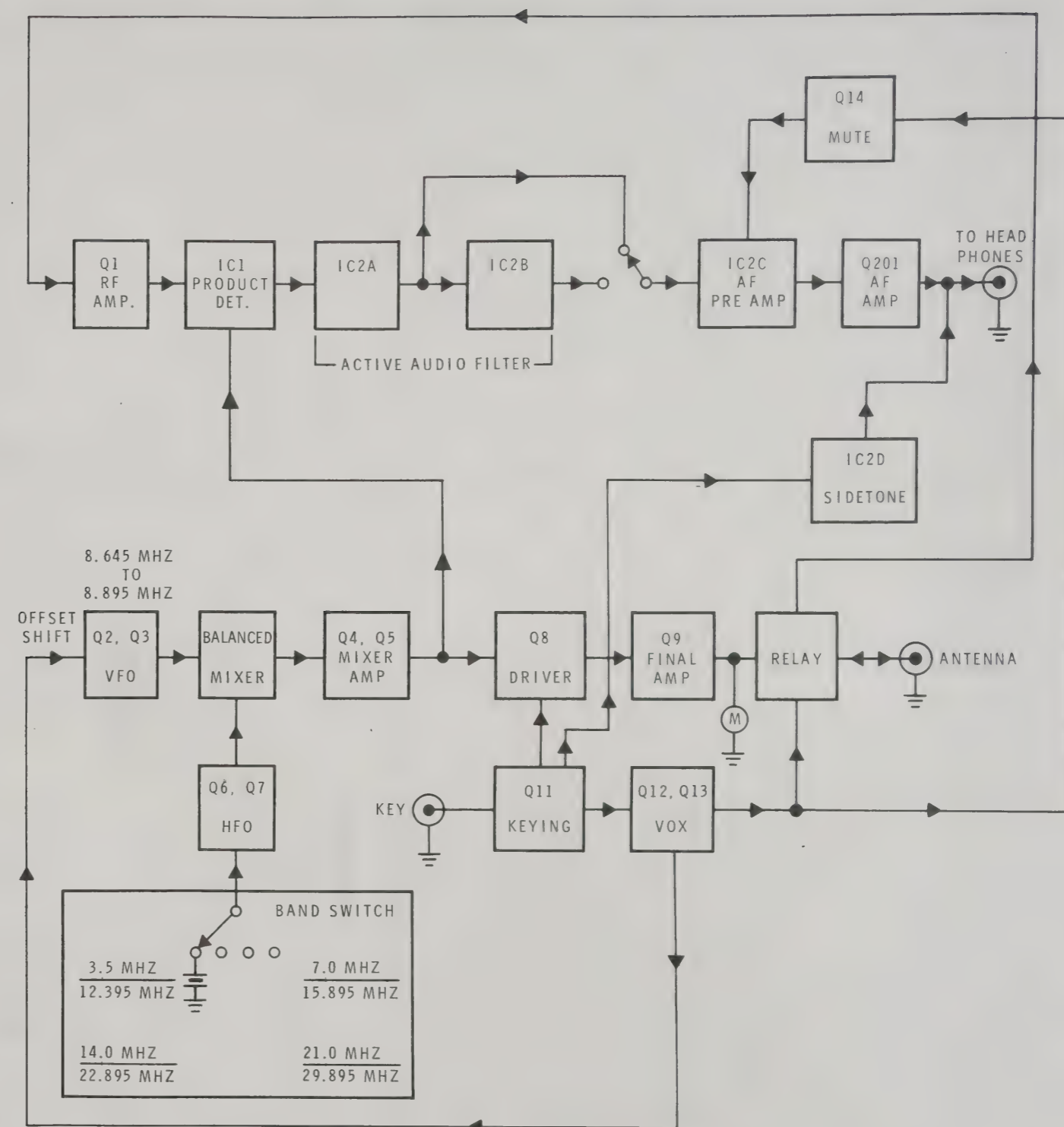


PICTORIAL 4-3



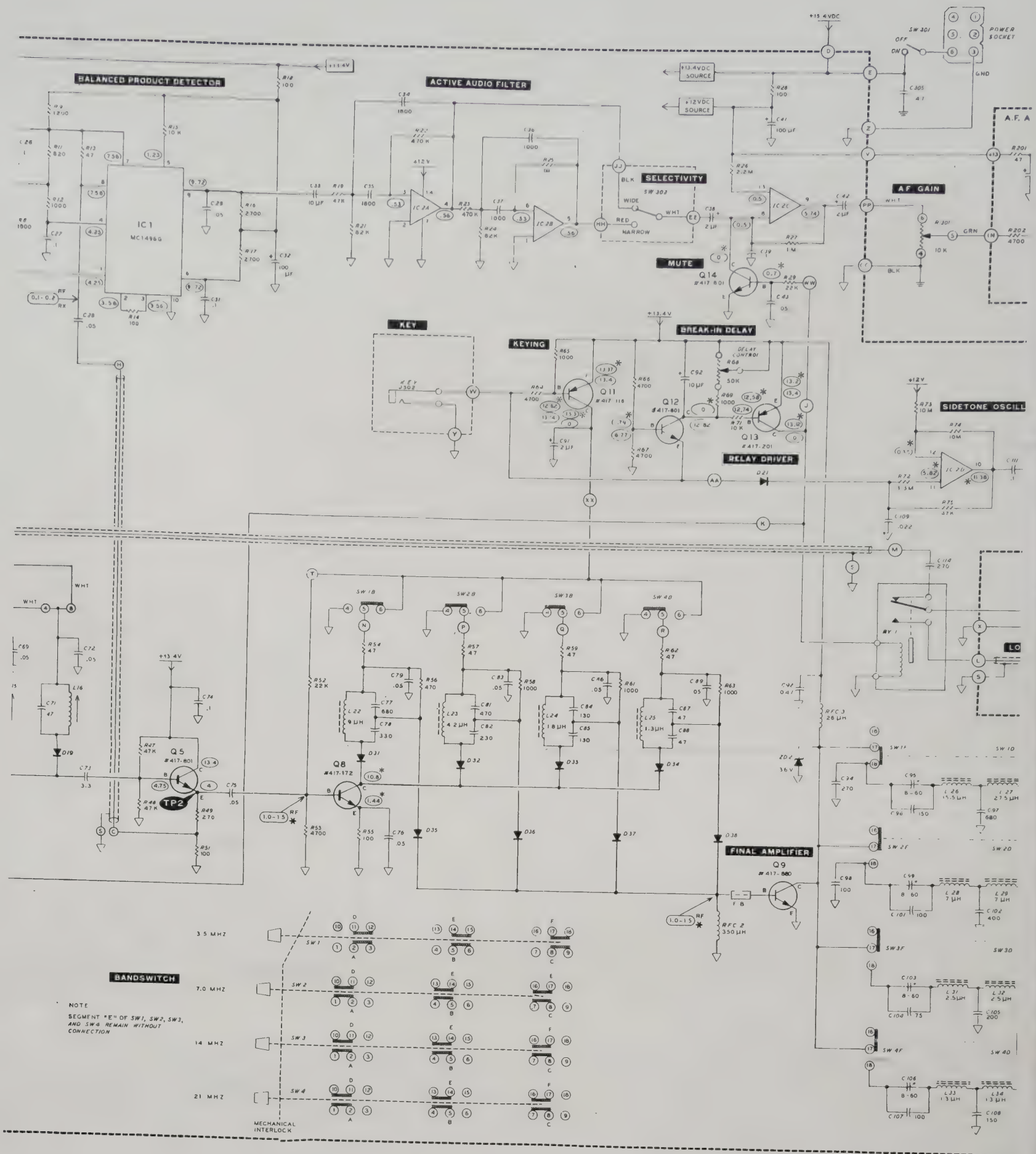


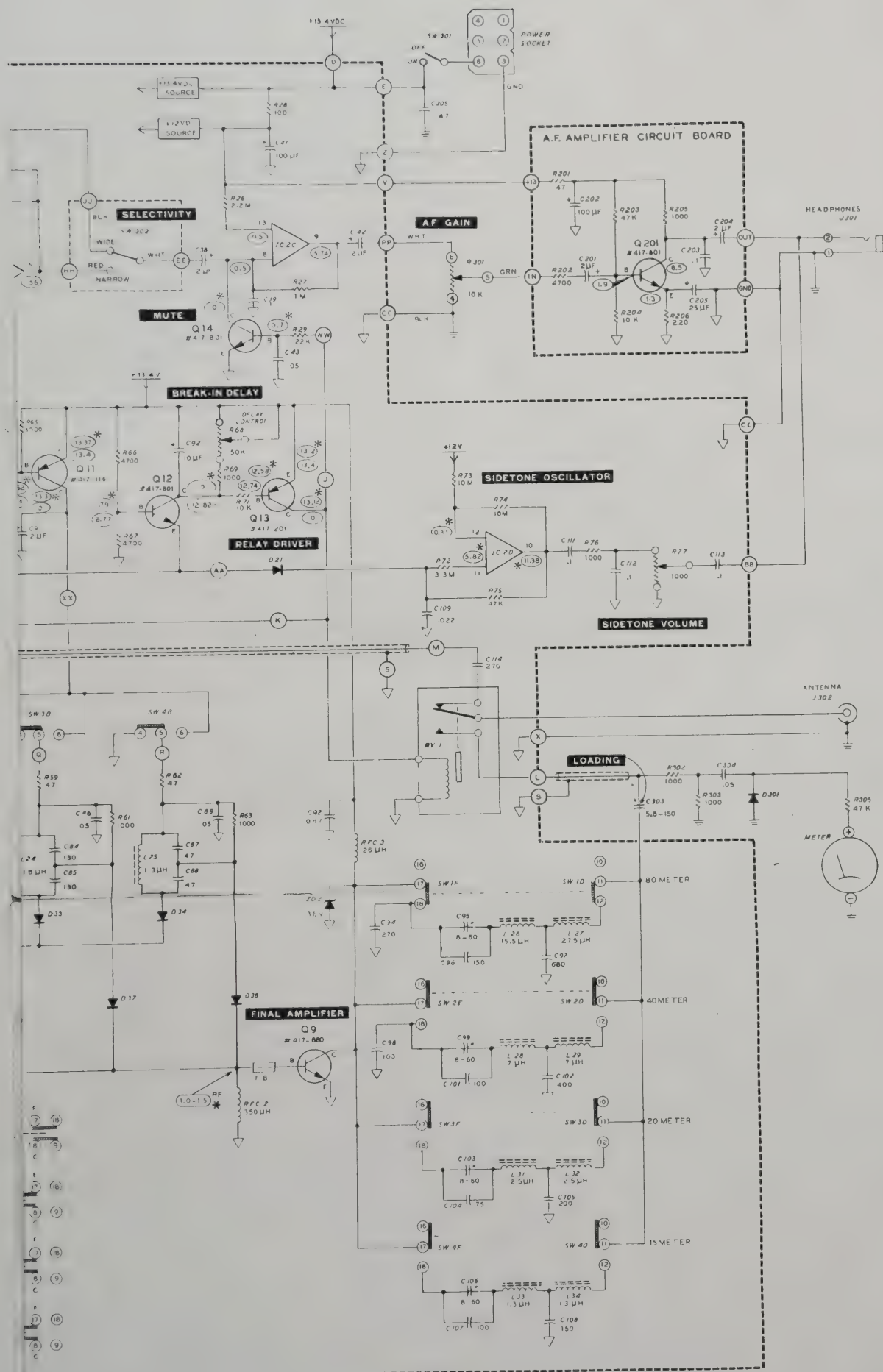
PICTORIAL 4-5



BLOCK DIAGRAM







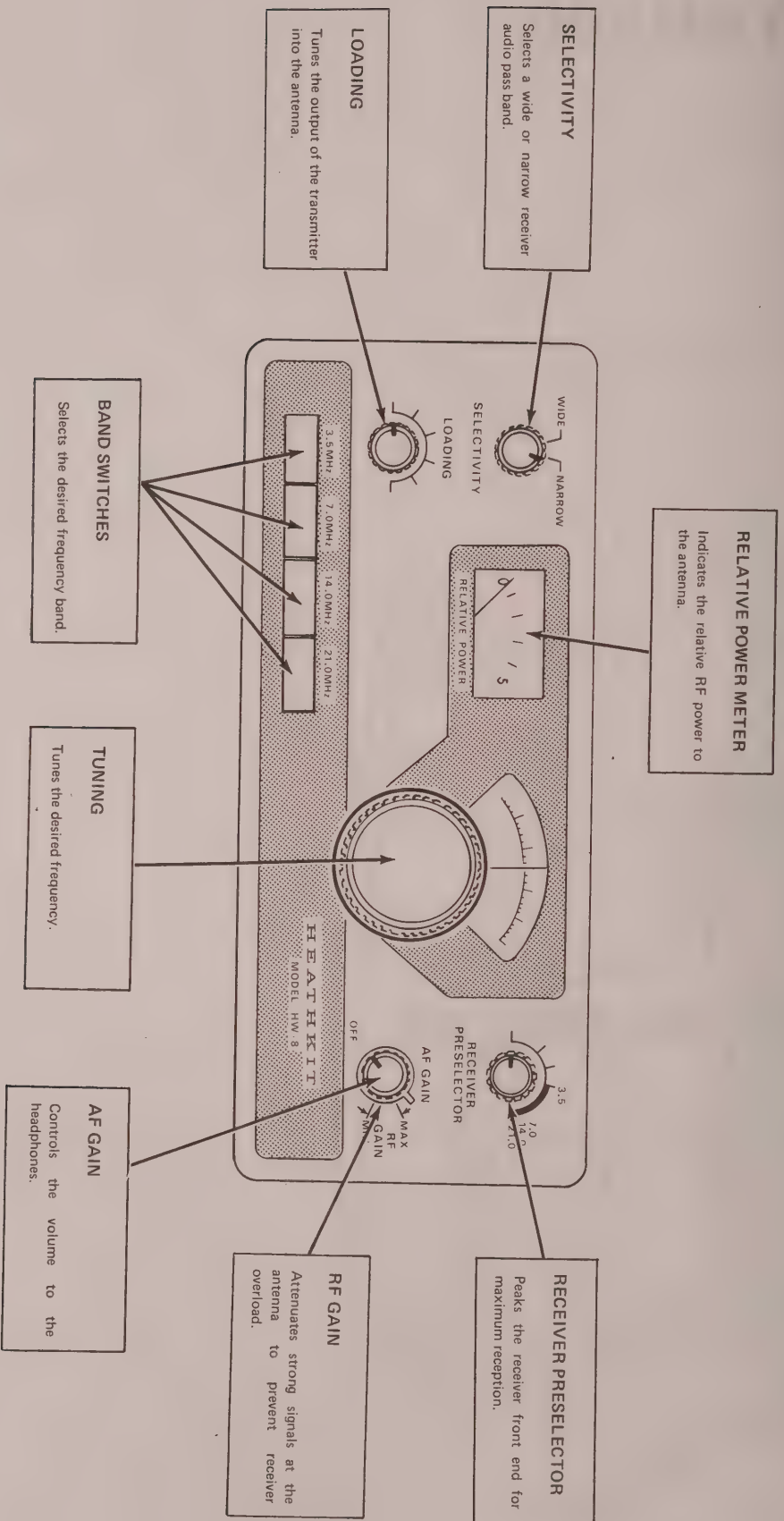


Figure 1-2

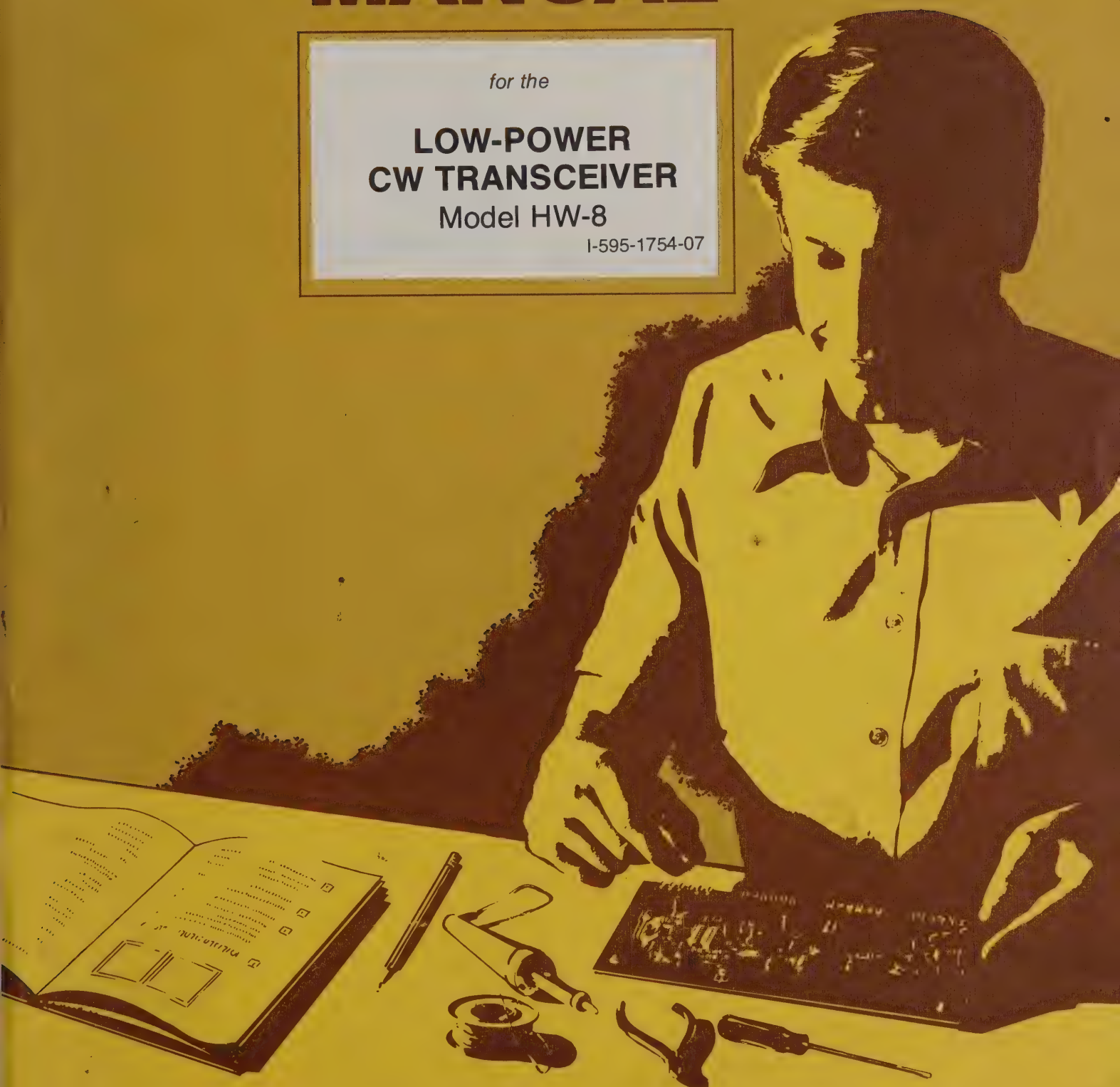
# HEATHKIT<sup>®</sup> MANUAL

*for the*

## LOW-POWER CW TRANSCEIVER

Model HW-8

I-595-1754-07



HEATH COMPANY • BENTON HARBOR, MICHIGAN

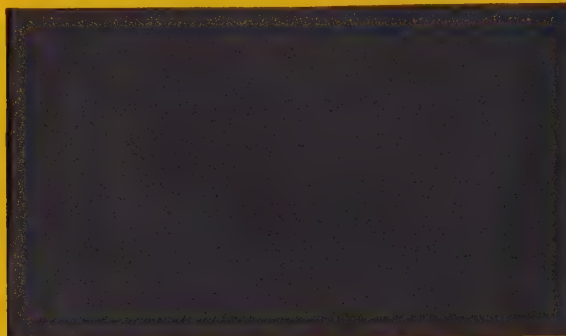
## HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information ..... (616) 982-3411  
Credit ..... (616) 982-3561  
Replacement Parts ..... (616) 982-3571

### *Technical Assistance Phone Numbers*

8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only  
R/C, Audio, and Electronic Organs ..... (616) 982-3310  
Amateur Radio ..... (616) 982-3296  
Test Equipment, Weather Instruments and  
Home Clocks ..... (616) 982-3315  
Television ..... (616) 982-3307  
Aircraft, Marine, Security, Scanners, Automotive,  
Appliances and General Products ..... (616) 982-3496  
Computers ..... (616) 982-3309



## YOUR HEATHKIT 90 DAY LIMITED WARRANTY

If you are not satisfied with our service - warranty or otherwise - or with our products, write directly to our Director of Customer Services, Heath Company, Benton Harbor, Michigan 49022. He will make certain your problems receive immediate, personal attention.

Our attorney, who happens to be quite a kitbuilder himself, insists that we describe our warranty using all the necessary legal phrases in order to comply with the new warranty regulations. Fine. Here they are:

For a period of ninety (90) days after purchase, Heath Company will replace or repair free of charge any parts that are defective either in materials or workmanship. You can obtain parts directly from Heath Company by writing us at the address below or by telephoning us at (616) 982-3571. And we'll pay shipping charges to get those parts to you — anywhere in the world.

We warrant that during the first ninety (90) days after purchase, our products, when correctly assembled, calibrated, adjusted and used in accordance with our printed instructions, will meet published specifications.

If a defective part or error in design has caused your Heathkit product to malfunction during the warranty period through no fault of yours, we will service it free upon proof of purchase and delivery at your expense to the Heath factory, any Heathkit Electronic Center (units of Schlumberger Products Corporation), or any of our authorized overseas distributors.

You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

Our warranty does not cover and we are not responsible for damage caused by the use of corrosive solder, defective tools, incorrect assembly, misuse, fire, or by unauthorized modifications to or uses of our products for purposes other than as advertised. Our warranty does not include reimbursement for customer assembly or set-up time.

This warranty covers only Heathkit products and is not extended to allied equipment or components used in conjunction with our products. **We are not responsible for incidental or consequential damages.** Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

HEATH COMPANY  
BENTON HARBOR, MI. 49022

SER #10848

# Heathkit® Manual

for the

## LOW-POWER CW TRANSCEIVER

Model HW-8

I-595-1754-07



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BENTON HARBOR, MICHIGAN 49022

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# INTRODUCTION

The Heathkit Model HW-8 Transceiver is a solid-state, four-band QRP (low power) unit covering the CW portion of the eighty, forty, twenty, and fifteen meter amateur bands. The direct-conversion receiver features an RF stage, a balanced product detector, and an active audio filter with wide or narrow selectivity.

Other features include diode band switching which is controlled by pushbuttons and a method of premixing the variable and heterodyne oscillator signals to provide the same dial read-out on all bands. This also provides excellent stability and a fixed frequency offset on all bands while you are transmitting.

In addition to indicating Relative Power, the panel meter is used during alignment to assure proper adjustment of the transmitter tuned circuits.

The HW-8 Transceiver may be operated from the Heathkit Accessory Power Supply Model HWA-7-1, an equivalent low impedance power supply, or from batteries.

*Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.*



# ASSEMBLY NOTES

A separate "Illustration Booklet" contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. The illustrations are arranged in Pictorial number sequence. Place the Booklet in a convenient location and keep it with the Assembly Manual.

Each circuit part has its own component number (R2, C4, L3, etc.). Use these numbers when you want to identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:

- In the parts list,
- At the beginning of each step where a component is installed,
- In some illustrations,

- In the Schematic,
- In the sections at the rear of the Manual.

Before you start to assemble this kit, read the wiring, soldering, and step-by-step assembly information in the "Kit Builders Guide."

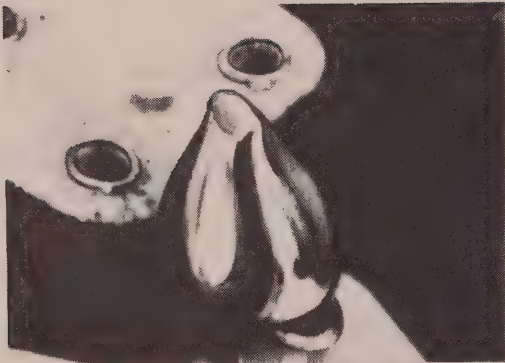
Resistors are identified by their value in ohms ( $\Omega$ ), kilohms ( $k\Omega$ ) or megohms ( $M\Omega$ ) and by color code.

Capacitors are identified by their type (disc, Mylar\*, electrolytic, tuning, trimmer, or polystyrene), and capacitance value in  $\mu F$  or pF.

\*Registered DuPont Trademark.

## SOLDERING INSTRUCTIONS

Poor soldering accounts for about 90% of all kit building problems. The following photographs show examples of the types of bad solder connections that are the most common cause of trouble. If you locate any of these bad solder connections in your kit, correct them as instructed. Study this section carefully before you begin to assemble your kit.



In this case, the solder was applied to the lead but did not flow onto the foil. To correct, reheat the connection.



Here, solder has flowed along a lead and bridged to another foil. To correct, hold the circuit board above the soldering iron and reheat the solder. As the solder melts, it will flow down the iron. Then cut off the excess lead length. PROTECT YOUR EYES.

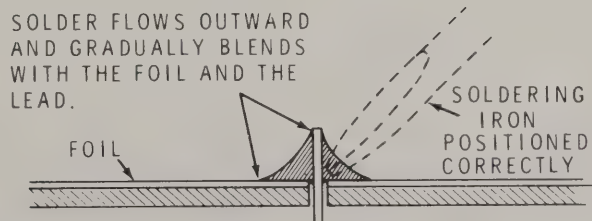


Here, hot solder has been dropped onto the foil and the solder connected or bridged (or crossed) three foils. To correct, hold the circuit board above the soldering iron and reheat the solder. As the solder melts, it will flow down the iron. PROTECT YOUR EYES.

NOTE: Solder that bridges two connections on the SAME FOIL is alright and should not be corrected.

Keep the soldering iron tip clean by wiping it from time to time with a damp sponge or cloth.

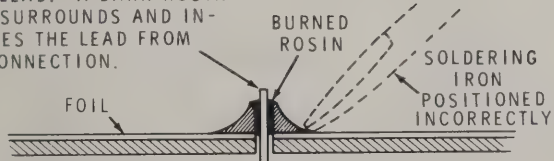
## A GOOD SOLDER CONNECTION



Heat both the lead and the circuit board foil at the same time. The solder will flow onto the lead and the foil evenly and will then make a good electrical connection between the lead and the foil.

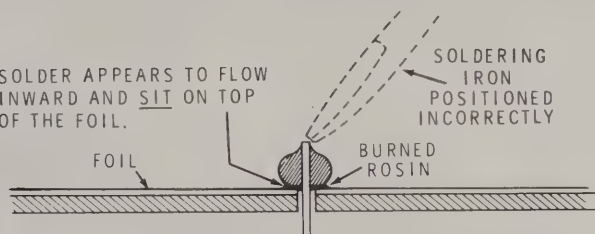
## BAD SOLDER CONNECTIONS

SOLDER DOES NOT FLOW ONTO LEAD. A DARK ROSIN BEAD SURROUNDS AND INSULATES THE LEAD FROM THE CONNECTION.



When the lead is not heated sufficiently, the solder will not flow onto the lead as shown above. Reheat the connection and, if necessary, apply a small amount of additional solder to obtain a connection as shown under "A Good Solder Connection."

SOLDER APPEARS TO FLOW INWARD AND SIT ON TOP OF THE FOIL.



When the foil is not heated sufficiently, the solder will blob on the circuit board as shown above. Reheat the connection and, if necessary, apply a small amount of additional solder to obtain a connection as shown under "A Good Solder Connection."



# CIRCUIT BOARD

## PARTS LIST

Open the container marked PTS #1 and check each part against the following list. You will also be instructed to remove some of the other parts that are left in the carton. These parts will be referred to as the "Parts From Final Pack." Make a check (✓) in the space provided as you identify each part. The illustrations show what the part looks like. Only the hardware is shown actual size.

Some parts are packaged in containers with the part number marked on the outside. Except for the initial parts check, keep these parts in their containers so they can be easily identified when they are called for in the assembly steps.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with the kit. If one is not available, see "Replacement Parts" inside the rear cover of this Manual. Your Warranty is located inside the front cover. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

### RESISTORS

NOTE: Resistors may be packed in more than one envelope. All resistors are 1/2-watt, 10% tolerance (silver fourth band) unless otherwise stated.

41 A1	(✓) 37	47 Ω (yellow-violet-black)	1-1
A1	(✓) 5 10	100 Ω (brown-black-brown)	1-3
A1	(✓) 1	220 Ω (red-red-brown)	1-45
A1	(✓) 1	270 Ω (red-violet-brown)	1-42
A1	(✓) 1 3 5	470 Ω (yellow-violet-brown)	1-6
A1	(✓) 1	820 Ω (gray-red-brown)	1-8

R13, R31,  
R54, R57, R59,  
R62, R201  
R14, R18, R28,  
R39, R41, R42,  
R46, R51, R55,  
R96  
R206  
R6, R49

R33, R34, R35,  
R56 R93  
R11

A1



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
<b>RESISTORS (cont'd.)</b>				
A1 (✓)	19	1000 $\Omega$ (brown-black-red)	1-9	R1, R2, R3, R4, R7, R8, R12, R36, R58, R61, R63, R65, R69, R76, R78, R82, R85, R88, R205
A1 (✓)	1	1200 $\Omega$ (brown-red-red)	1-10	R9
A1 (✓)	12	2700 $\Omega$ (red-violet-red)	1-13	R16, R17
A1 (✓)	1	3300 $\Omega$ (orange-orange-red)	1-14	R92
+1 A1 (✓)	25	4700 $\Omega$ (yellow-violet-red)	1-16	R53, R64, R66, R67, R202
A1 (✓)	24	6800 $\Omega$ (blue-gray-red)	1-19	R79, R83, R86, R89
A1 (✓)	1254	10 k $\Omega$ (brown-black-orange)	1-20	R15, R50, R71, R204
+2 A1 (✓)	4	22 k $\Omega$ (red-red-orange)	1-22	R29, R37, R52, R95
A1 (✓)	38	47 k $\Omega$ (yellow-violet-orange)	1-25	R19, R44, R47, R48, R75, R203
A1 (✓)	12	68 k $\Omega$ (blue-gray-orange)	1-60	R38, R94
A1 (✓)	18	82 k $\Omega$ (gray-red-orange)	1-102	R21, R24
+1 A1 (✓)	37	100 k $\Omega$ (brown-black-yellow)	1-26	R5, R43, R45, R81, R84, R87, R91
A1 (✓)	12	470 k $\Omega$ (yellow-violet-yellow)	1-33	R22, R23
A1 (✓)	125	1 M $\Omega$ (brown-black-green)	1-35	R25, R27, R32
A1 (✓)	1	2.2 M $\Omega$ (red-red-green)	1-37	R26
A1 (✓)	1	3.3 M $\Omega$ (orange-orange-green)	1-38	R72
A1 (✓)	2	10 M $\Omega$ (brown-black-blue)	1-40	R73, R74

A1



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

## CAPACITORS

### Mica

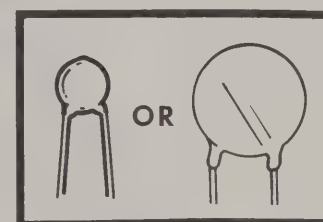
B1	(✓)	1	24 pF	20-77	C123
B1	(✓)	5	47 pF	20-101	C71, C87, C88, C15, C121
B1	(✓)	2	68 pF	20-76	C1, C4
B1	(✓)	2	75 pF	20-110	C18, C104
B1	(✓)	6	100 pF	20-102	C61, C68, C98, C101, C107, C116
B1	(✓)	3	130 pF	20-104	C84, C85, C118
B1	(✓)	3	150 pF	20-103	C66, C96, C108
B1	(✓)	1	200 pF	20-108	C105
B1	(✓)	2	230 pF	20-111	C64, C82
B1	(✓)	2	270 pF	20-114	C94, C114
B1	(✓)	1	330 pF	20-139	C78
B1	(✓)	1	400 pF	20-116	C102
B1	(✓)	1	470 pF	20-128	C81
B1	(✓)	2	680 pF	20-107	C77, C97



### Disc

C1	(✓)	4	3.3 pF	21-33	C12, C54, C73, C127
C1	(✓)	1	5 pF	21-157	C125
C1	(✓)	1	6 pF	21-169	C55
C1	(✓)	1	6.8 pF	21-703	C47
C1	(✓)	2	10 pF	21-3	C25, C126
C1	(✓)	1	27 pF	21-716	C48
C1	(✓)	2	56 pF	21-160	C49, C51
C1	(✓)	3	510 pF	21-191	C44, C45, C46
C1	(✓)	34	.05 $\mu$ F	21-143	C2, C5, C8, C11, C13, C14, C17, C21, C23, C28, C29, C43, C52, C56, C57, C58, C59, C62, C63, C65, C67, C69, C72, C75, C76, C79, C83, C86, C89, C115, C117, C119, C122, C128

C1



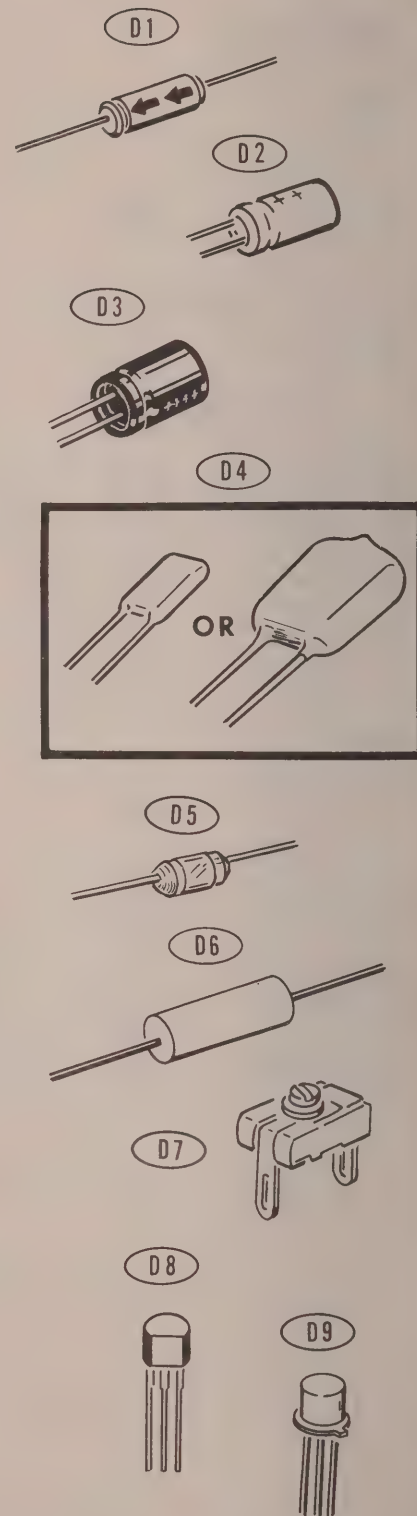
KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
<b>Other Capacitors</b>				
D1 (✓)	5	2 $\mu$ F electrolytic	25-123	C38, C42, C91, C201, C204
D1 (✓)	1	25 $\mu$ F electrolytic	25-96	C205
D2 (✓)	2	10 $\mu$ F electrolytic	25-115	C33, C92
D3 (✓)	3	100 $\mu$ F electrolytic	25-117	C32, C41, C202
D4 (✓)	1	.022 $\mu$ F Mylar	27-63	C109
D4 (✓)	9	.1 $\mu$ F Mylar	27-47	C26, C27, C31, C39, C74, C111, C112, C113, C203
D4 (✓)	1	.47 $\mu$ F Mylar	27-86	C93
D5 (✓)	2	1000 pF polystyrene	29-5	C36, C37
D5 (✓)	2	1800 pF, (1.8n) polystyrene	29-4	C34, C35
D6 (✓)	1	4.7 pF ceramic	21-29	C53
D7 (✓)	3	4 to 40 pF trimmer	31-54	C6, C16, C19
D7 (✓)	9	8 to 60 pF trimmer	31-52	C3, C7, C9, C22, C24, C95, C99, C103, C106

## TRANSISTORS — INTEGRATED CIRCUITS (IC's)

NOTE: Transistors and IC's are marked for identification in one of the following ways:

1. Part number.
2. Type number. (On integrated circuits this refers only to the numbers; the letters may be different or missing.)
3. Part number and type number.
4. Part number and a type number other than the one listed.

D8 (✓)	2	MPF105 transistor (JFET)	417-169	Q1, Q2
D8 (✓)	6	MPS-A20 transistor	417-801	Q3, Q5, Q7, Q12, Q14, Q201
D8 (✓)	1	S2091 transistor	417-116	Q11
D9 (✓)	1	40673 transistor (MFET)	417-240	Q4



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

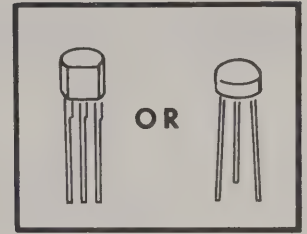
### Transistors-Integrated Circuits (IC's)

D10 (✓)	2	MPS6521 transistor	417-172	Q6, Q8
D11 (✓)	1	2N4427 transistor	417-880	Q9
D12 (✓)	1	X29A829 transistor	417-201	Q13
D13 (✓)	1	MC1496G IC (inte- grated circuit)	442-96	IC1
D14 (✓)	1	LM3900	442-71	IC2

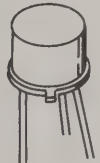
### CRYSTALS

D15 (✓)	1	12.395 MHz	404-207	Y1
D15 (✓)	1	15.895 MHz	404-208	Y2
D15 (✓)	1	22.895 MHz	404-209	Y3
D15 (✓)	1	29.895 MHz	404-210	Y4

D10



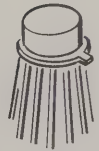
D11



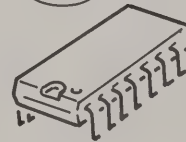
D12



D13



D14



D15



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
D16 (✓)	1	1000 $\Omega$ control	10-936	R77
D16 (✓)	1	50 k $\Omega$ control	10-222	R68

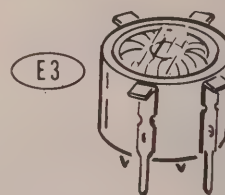


CAUTION: Do not remove the coils or chokes from their envelopes until they are called for in a step.

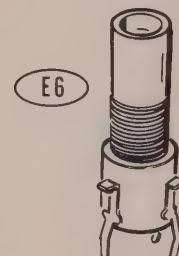
E1 (✓)	4	1.3 $\mu$ H toroid coil	40-1800	L8, L25, L33, L34
E1 (✓)	2	1.8 $\mu$ H toroid coil	40-1792	L7, L24
E1 (✓)	2	2.5 $\mu$ H toroid coil	40-1609	L31, L32
E1 (✓)	2	4.2 $\mu$ H toroid coil	40-1798	L6, L23
E1 (✓)	2	7.0 $\mu$ H toroid coil	40-1726	L28, L29
E1 (✓)	1	9.0 $\mu$ H toroid coil	40-1797	L22
E1 (✓)	2	15.5 $\mu$ H toroid coil	40-1882	L5, L26
E1 (✓)	1	27.5 $\mu$ H toroid coil	40-1791	L27
E2 (✓)	2	15.0 $\mu$ H toroid coil	40-1050	L11, L12
E3 (✓)	2	1.8 $\mu$ H toroid coil	40-1788	L3, L4
E3 (✓)	1	4.7 $\mu$ H toroid coil	40-1787	L2
E3 (✓)	1	13.0 $\mu$ H toroid coil	40-1786	L1
E4 (✓)	1	.83 $\mu$ H coil	40-1804	L19/L21
E4 (✓)	1	1.47 $\mu$ H coil	40-1803	L17/L18
E5 (✓)	1	4.0 $\mu$ H coil	40-1795	L14
E5 (✓)	2	1.3 $\mu$ H coil	40-1796	L15, L16
E5 (✓)	1	8.0 $\mu$ H coil	40-1794	L13
E6 (✓)	1	5.0 $\mu$ H coil	40-1802	L9
E7 (✓)	1	26.0 $\mu$ H choke	45-62	RFC3
E8 (✓)	2	350 $\mu$ H choke	45-82	RFC1, RFC2



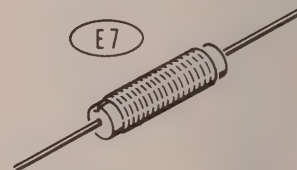
E2



E5



E7



E8



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

## DIODES

E9	(4)	1	VR-9.1 zener	56-19
E9	(4)	1	VR-36 zener	56-55
E9	(4)	4	FH1100	56-87
E9	(4)	23	1N458	56-24

E9	(4)	8	1N4149	56-56
----	-----	---	--------	-------

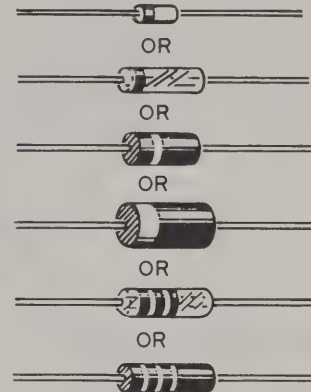
## MISCELLANEOUS

E10	(4)	1	Pushbutton switch assembly	64-775
E11	(4)	1	Relay	69-47
E12	(4)	1	Heat sink	215-45
E13	(4)	1	IC socket	434-298
E14	(4)	1	Ferrite bead	475-10

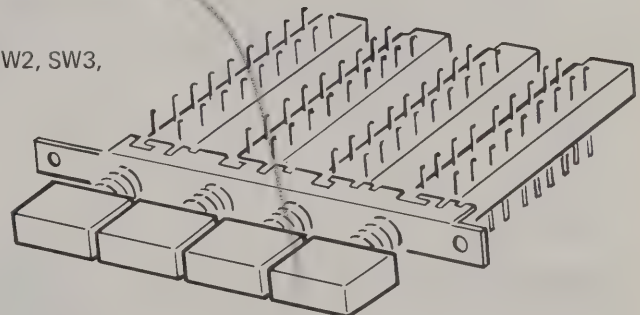
ZD1  
ZD2  
D12, D13, D14,  
D15  
D1, D2, D3, D4,  
D5, D6, D7, D8,  
D9, D11, D16, D17,  
D18, D19, D21, D31,  
D32, D33, D34, D35,  
D36, D37, D38  
D22, D23, D24, D25,  
D26, D27, D28, D29

E9

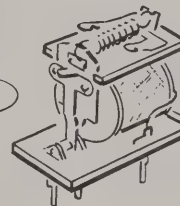
NOTE: HEATH PART NUMBERS ARE STAMPED ON MOST DIODES.



E10



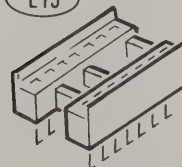
E11



E12



E13



E14



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

## Miscellaneous (cont'd.)

E15	(✓) 3	Cable tie	354-5	
E16	(✓) 4	6-32 x 1/4" screw	250-56	
E17	(✓) 3	6-32 nut	252-3	
E18	(✓) 4	#6 lockwasher	254-1	
E19	(✓) 1	6-32 x 1/2" spacer	255-23	

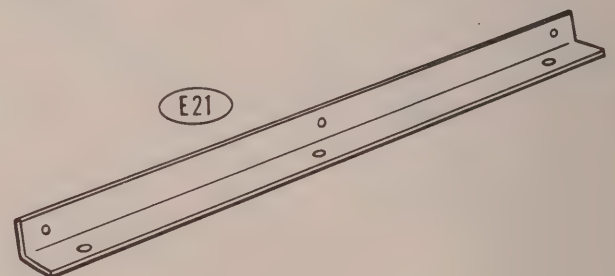
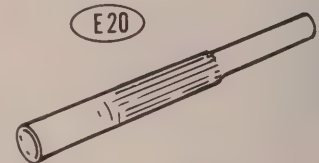
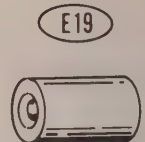
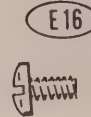
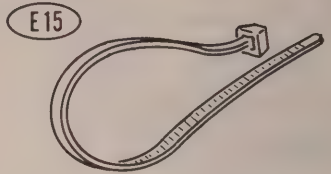
## PARTS FROM FINAL PACK

E20	(✓) 1	Nut starter	490-5	
E21	(✓) 1	Angle bracket	204-1844	
	(✓) 11'	Yellow wire	344-54	
	(✓) 5'	5-wire cable	347-39	
	(✓) 6'	Shielded cable	343-15	
	(✓) 1	Main circuit board	85-1748-5	
	(✓) 1	AF Amplifier circuit board	85-1677-1	
	(✓)	Solder		

## PRINTED MATERIAL

NOTE: Be sure you refer to the numbers on the blue and white label in any communications you may have about this kit with Heath Company. You may want to write the model and series numbers in the sample label for future convenience.

(✓)	1	Blue and white label	391-34
(✓)	1	Parts Order Form	597-260
(✓)	1	Kit Builders Guide	597-308
(✓)	1	Manual (See front cover for part number.)	
( )	1	Technical letter	597-1412



391-34

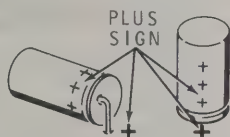
HEATH	
MODEL	SERIES NO.
HW8	10848

# STEP-BY-STEP ASSEMBLY

## START

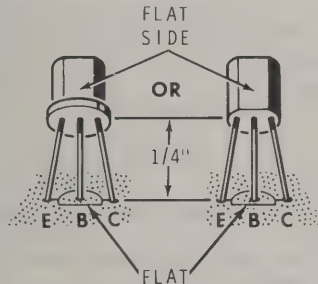
Position the AF Amplifier circuit board as shown. Then perform the steps in the order listed.

NOTE: When you install an electrolytic capacitor, always connect the lead at the positive (+) end of the capacitor to the positive (+) marked point on the circuit board.



(✓) C205: 25  $\mu$ F electrolytic.

NOTE: When you install the following transistor, line up the flat on the transistor with the outline of the flat on the circuit board. Then insert the E, B, and C leads of the transistor into the corresponding E, B, and C holes in the circuit board. Position the transistor 1/4" above the circuit board, solder the leads to the foil, and cut off the excess lead lengths.



(✓) Q201: MPS-A20 transistor (#417-801).

(✓) C204: 2  $\mu$ F electrolytic.

(✓) R201: 47  $\Omega$  (yellow-violet-black).

(✓) R202: 4700  $\Omega$  (yellow-violet-red).

(✓) C201: 2  $\mu$ F electrolytic.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN. WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



OK

## CONTINUE

(✓) R206: 220  $\Omega$  (red-red-brown).

(✓) C203: .1  $\mu$ F Mylar.

(✓) R204: 10 k $\Omega$  (brown-black-orange).

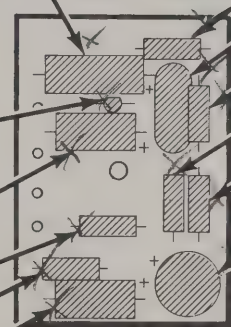
(✓) R205: 1000  $\Omega$  (brown-black-red).

(✓) R203: 47 k $\Omega$  (yellow-violet-orange).

(✓) C202: 100  $\mu$ F electrolytic.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

(✓) Save two of the cut off resistor leads. They will be used when you install jumper wires on the main circuit board.



PICTORIAL 1-1

**START**

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



NOTE: When you prepare the wires in the following steps, cut the wire to the length specified in the step and remove 1/4" of insulation from each end. Solder one end of each wire to the foil and cut off the excess wire lengths.

(✓) 2" yellow wire.

(✓) 2-3/4" yellow wire.

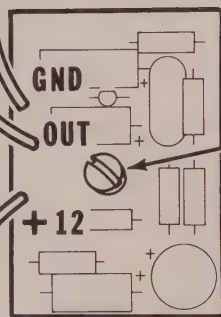
(✓) 3" yellow wire.

NOTE: The hole marked "IN" on the circuit board will be used later.

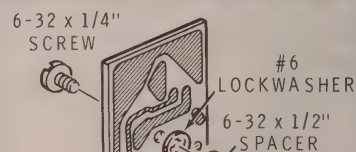
2-3/4"  
YEL.

2"  
YEL

3"  
YEL

**CONTINUE**

CAUTION: When you perform the next step, be sure the lockwasher does not touch the adjacent foil.



FOIL SIDE  
OF  
CIRCUIT BOARD

Mount a 6-32 x 1/2" spacer on the foil side of the circuit board as shown above.

**CIRCUIT BOARD CHECKOUT**

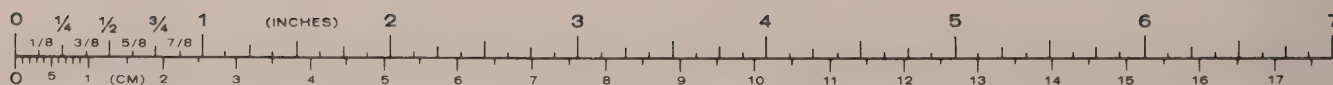
Carefully inspect the circuit board for the following conditions.

- (✓) Unsoldered connections.
- (✓) "Cold" solder connections.
- (✓) Solder bridges between foil patterns.
- (✓) Protruding leads which could touch together.
- (✓) Transistors for the proper type and installation.
- (✓) Electrolytic capacitors for the correct position of the positive (+) lead.

Set the circuit board aside until it is called for later.

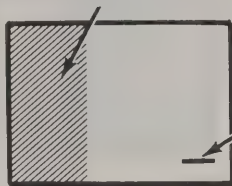
**FINISH**

PICTORIAL 1-2



OK

The steps performed in this Pictorial are in this area of the circuit board.

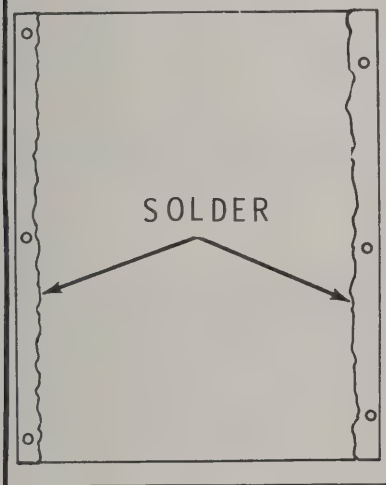


PART  
NUMBER

IDENTIFICATION  
DRAWING

## START

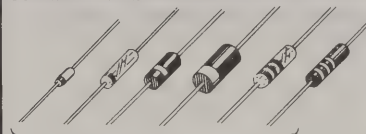
Position the main circuit board foil-side-up as shown below. Then apply a thin coating of solder along the indicated edges of the circuit board. This will assure a good ground connection when the circuit board is mounted later.



## CONTINUE

Position the main circuit board component side up as shown. Then perform the steps in the order listed.

**IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.**



**BANDED END**

BE SURE YOU INSTALL EACH DIODE SO ITS BANDED END IS POSITIONED AS SHOWN IN THE PICTORIAL.

Install eight 1N458 diodes (#56-24).

(✓) D34.

(✓) D33.

(✓) D32.

(✓) D31.

(✓) D35.

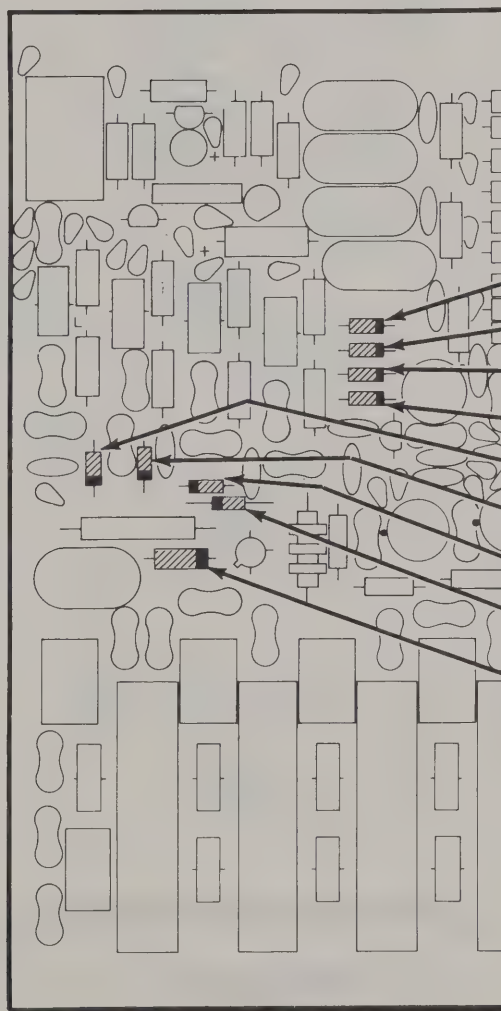
(✓) D36.

(✓) D37.

(✓) D38.

(✓) ZD2: VR-36 zener diode (#56-55).

(✓) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 2-1

*OK*

The steps performed in this Pictorial are in this area of the circuit board.



PART  
NUMBER

IDENTIFICATION  
DRAWING

# **START**

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



Install eight 1N4149 diodes (#56-56).

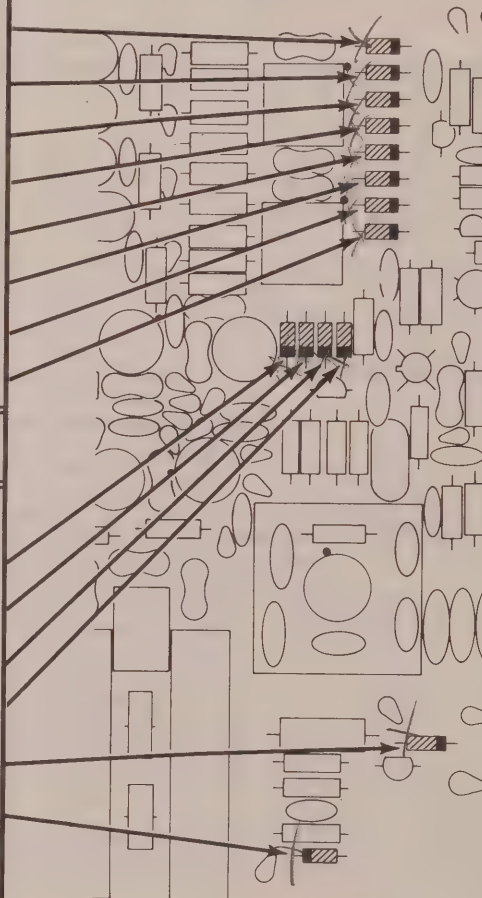
- ☒ D23. ....
- ☒ D22. ....
- ☒ D24. ....
- ☒ D25. ....
- ☒ D26. ....
- ☒ D29. ....
- ☒ D27. ....
- ☒ D28. ....

☒ Solder the leads to the foil and cut off the excess lead lengths.

Install six 1N458 diodes (#56-24).

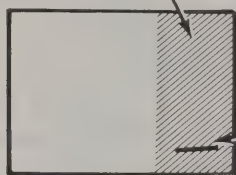
- ☒ D16. ....
- ☒ D17. ....
- ☒ D18. ....
- ☒ D19. ....
- ☒ D9. ....
- ☒ D11. ....

☒ Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 2-2

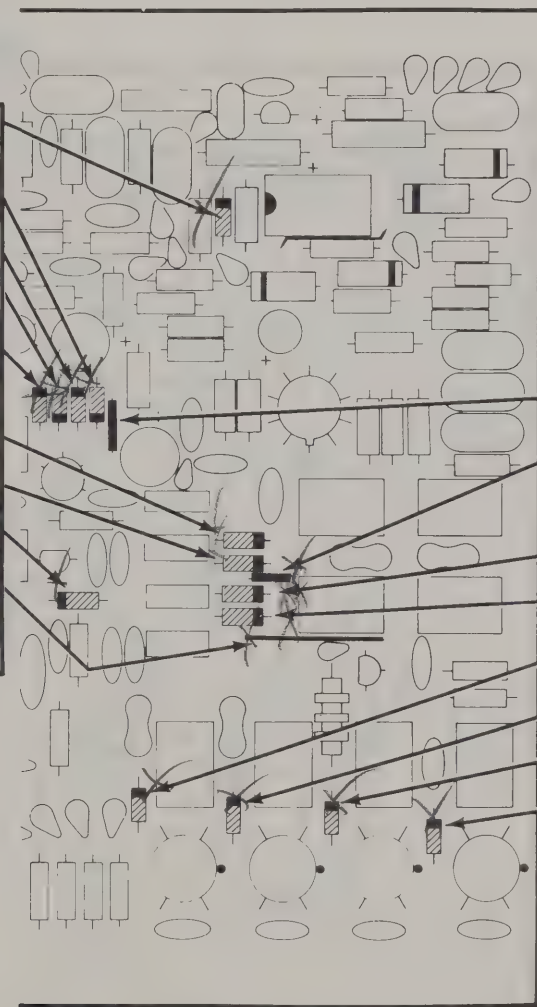
The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION  
DRAWING

**START**

- (✓) D21: 1N458 diode (#56-24).
- Install four FH1100 diodes (#56-87).
- (✓) D12. ....
- (✓) D13. ....
- (✓) C15. ....
- (✓) D14. ....
- Install two 1N458 diodes (#56-24).
- (✓) D8. ....
- (✓) D7. ....
- (✓) ZD1: VR-9.1 zener diode (#56-19).
- (✓) 1-1/2" yellow wire at J.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

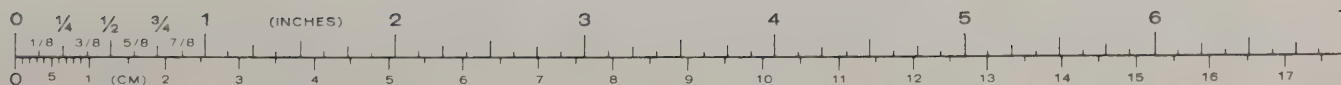


**CONTINUE**

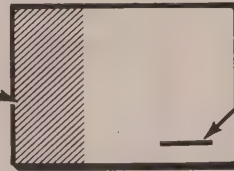
NOTE: Use the previously saved cut off resistor leads when you install the following jumper wires.

- (✓) 1" yellow wire at J.
- (✓) 1" yellow wire at J.
- Install six 1N458 diodes (#56-24).
- (✓) D6.
- (✓) D5.
- ( ) D1.
- ( ) D2.
- ( ) D3.
- ( ) D4.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-3



The steps performed in this Pictorial are in this area of the circuit board.



PART  
NUMBER

IDENTIFICATION  
DRAWING

### START

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



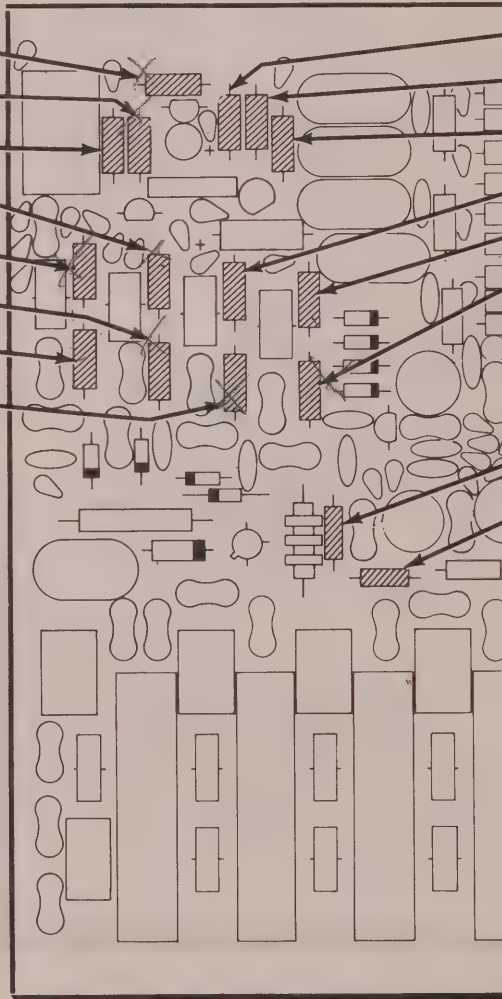
- (✓) R67: 4700  $\Omega$  (yellow-violet-red).
- (✓) R69: 1000  $\Omega$  (brown-black-red).
- (✓) R71: 10 k $\Omega$  (brown-black-orange).
- (✓) R57: 47  $\Omega$  (yellow-violet-black).
- (✓) R54: 47  $\Omega$  (yellow-violet-black).
- (✓) R58: 1000  $\Omega$  (brown-black-red).
- (✓) R56: 470  $\Omega$  (yellow-violet-brown).
- (✓) R61: 1000  $\Omega$  (brown-black-red).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

### CONTINUE

- (✓) R66: 4700  $\Omega$  (yellow-violet-red).
- (✓) R64: 4700  $\Omega$  (yellow-violet-red).
- (✓) R65: 1000  $\Omega$  (brown-black-red).
- (✓) R59: 47  $\Omega$  (yellow-violet-black).
- (✓) R62: 47  $\Omega$  (yellow-violet-black).
- (✓) R63: 1000  $\Omega$  (brown-black-red).



- (✓) R55: 100  $\Omega$  (brown-black-brown).
- (✓) R53: 4700  $\Omega$  (yellow-violet-red).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 2-4

The steps performed in this Pictorial are in this area of the circuit board.



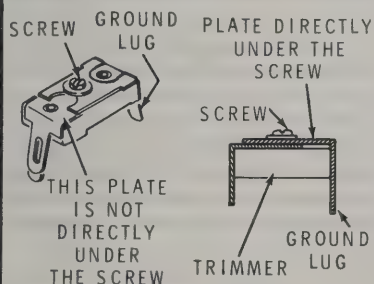
PART  
NUMBER

IDENTIFICATION  
DRAWING

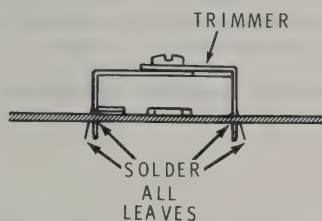
## START

### NOTES:

1. You will install four trimmer capacitors on the circuit board in the following steps. Note that there are two different values of trimmers.
2. Some of the trimmer lugs have two or more leaves. When you install the trimmer, make sure all of the lug leaves go through the circuit board.
3. IT IS VERY IMPORTANT to solder the correct trimmer lug to the correct foil. One lug on each trimmer will be called the ground lug. This is the lug that is connected to the metal plate directly under the screw on the trimmer.



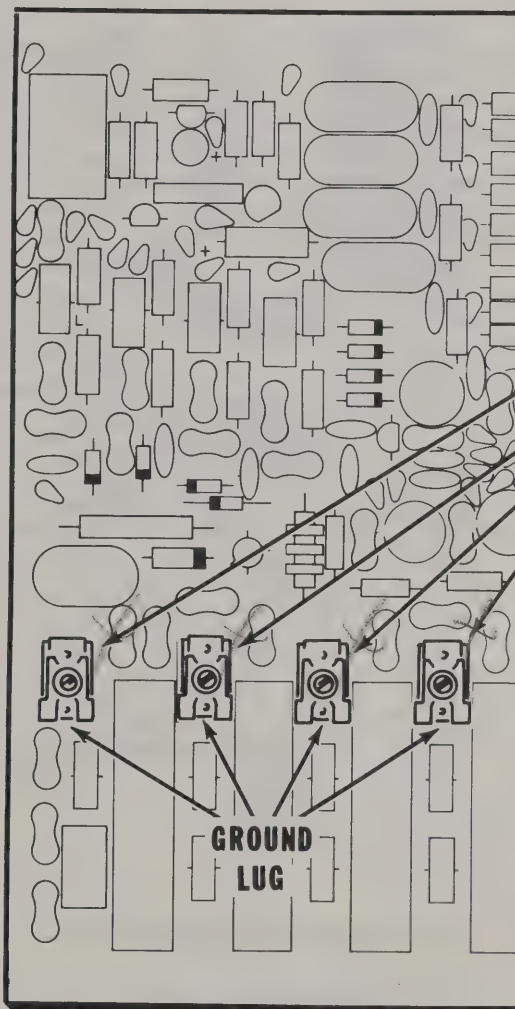
4. Make sure that each trimmer capacitor is properly positioned and soldered to the foil. If a trimmer lug has more than one leaf, make sure all leaves are soldered.



## CONTINUE

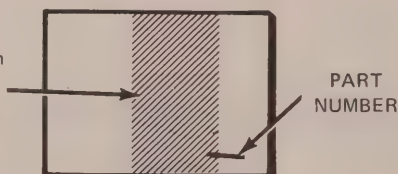
NOTE: In the following steps, solder the lugs to the foil as you install each trimmer.

- (✓) C95: 8-60 pF trimmer (#31-52).
- (✓) C99: 8-60 pF trimmer (#31-52).
- (✓) C103: 8-60 pF trimmer (#31-52).
- (✓) C106: 8-60 pF trimmer (#31-52).



PICTORIAL 2-5

The steps performed in this Pictorial are in this area of the circuit board.

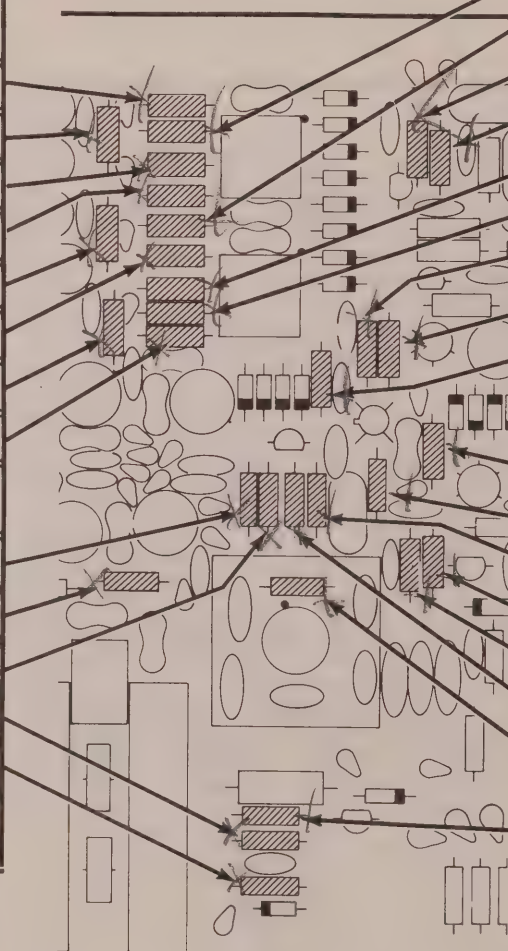
**START** ➡

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



- (✓) R79: 6800  $\Omega$  (blue-gray-red).
- (✓) R81: 100 k $\Omega$  (brown-black-yellow).
- (✓) R83: 6800  $\Omega$  (blue-gray-red).
- (✓) R82: 1000  $\Omega$  (brown-black-red).
- (✓) R84: 100 k $\Omega$  (brown-black-yellow).
- (✓) R85: 1000  $\Omega$  (brown-black-red).
- (✓) R87: 100 k $\Omega$  (brown-black-yellow).
- (✓) R91: 100 k $\Omega$  (brown-black-yellow).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) R51: 100  $\Omega$  (brown-black-brown).
- (✓) R52: 22 k $\Omega$  (red-red-orange).
- (✓) R49: 270  $\Omega$  (red-violet-brown).
- (✓) R34: 470  $\Omega$  (yellow-violet-brown).
- (✓) R36: 1000  $\Omega$  (brown-black-red).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

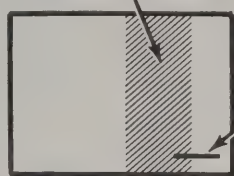
IDENTIFICATION  
DRAWING**CONTINUE** ➡

- (✓) R78: 1000  $\Omega$  (brown-black-red).
- (✓) R86: 6800  $\Omega$  (blue-gray-red).
- (✓) R92: 3300  $\Omega$  (orange-orange-red).
- (✓) R93: 470  $\Omega$  (yellow-violet-brown).
- (✓) R89: 6800  $\Omega$  (blue-gray-red).
- (✓) R88: 1000  $\Omega$  (brown-black-red).
- (✓) R44: 47 k $\Omega$  (yellow-violet-orange).
- (✓) R45: 100 k $\Omega$  (brown-black-yellow).
- (✓) R46: 100  $\Omega$  (brown-black-brown).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) R39: 100  $\Omega$  (brown-black-brown).
- (✓) R43: 100 k $\Omega$  (brown-black-yellow).
- (✓) R47: 47 k $\Omega$  (yellow-violet-orange).
- (✓) R38: 68 k $\Omega$  (blue-gray-orange).
- (✓) R33: 470  $\Omega$  (yellow-violet-brown).
- (✓) R48: 47 k $\Omega$  (yellow-violet-orange).
- (✓) R31: 47  $\Omega$  (yellow-violet-black).
- (✓) R32: 1 M $\Omega$  (brown-black-green).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-6

OK

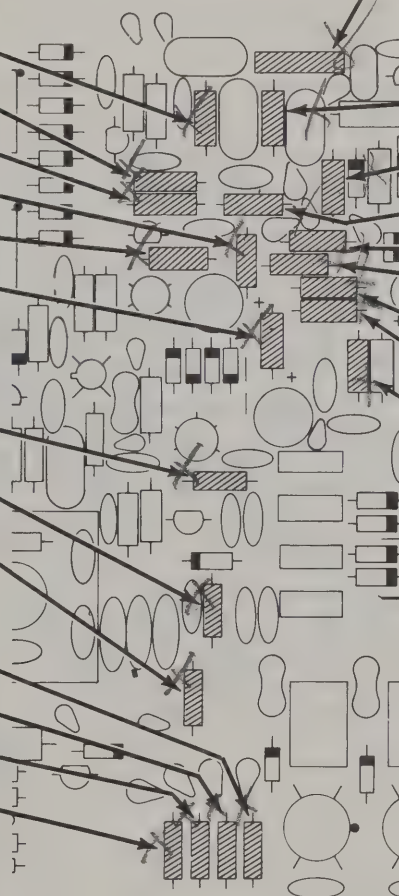
The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION DRAWING

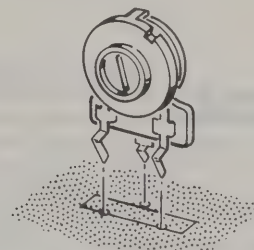
**START**

- (✓) R76: 1000  $\Omega$  (brown-black-red).
- (✓) R95: 22 k $\Omega$  (red-red-orange).
- (✓) R94: 68 k $\Omega$  (blue-gray-orange).
- (✓) R26: 2.2 M $\Omega$  (red-red-green).
- (✓) R42: 100  $\Omega$  (brown-black-brown).
- (✓) R18: 100  $\Omega$  (brown-black-brown).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) R41: 100  $\Omega$  (brown-black-brown).
- (✓) R37: 22 k $\Omega$  (red-red-orange).
- (✓) R35: 470  $\Omega$  (yellow-violet-brown).
- Install four 1000  $\Omega$  (brown-black-red) resistors.
- (✓) R1. ....
- (✓) R2. ....
- (✓) R3. ....
- (✓) R4. ....
- (✓) Solder the leads to the foil and cut off the excess lead lengths.



**CONTINUE**

- (✓) R77: 1000  $\Omega$  control (#10-936).  
Solder the lugs to the foil.



- (✓) R75: 47 k $\Omega$  (yellow-violet-orange).
- (✓) R74: 10 M $\Omega$  (brown-black-blue).
- (✓) R96: 100  $\Omega$  (brown-black-brown).
- (✓) R73: 10 M $\Omega$  (brown-black-blue).
- (✓) R28: 100  $\Omega$  (brown-black-brown).
- (✓) R17: 2700  $\Omega$  (red-violet-red).
- (✓) R16: 2700  $\Omega$  (red-violet-red).
- (✓) R11: 820  $\Omega$  (gray-red-brown).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-7

OK

The steps performed in this Pictorial are in this area of the circuit board.

PART  
NUMBER



IDENTIFICATION  
DRAWING

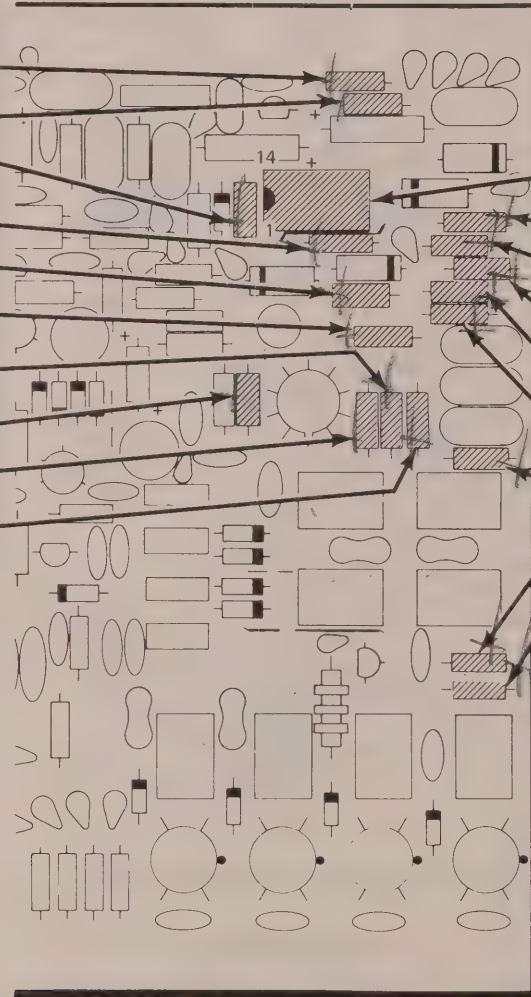
## START

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.

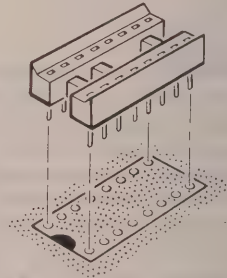


- (✓) R29: 22 kΩ (red-red-orange).
- (✓) R27: 1 MΩ (brown-black-green).
- (✓) R72: 3.3 MΩ (orange-orange-green).
- (✓) R22: 470 kΩ (yellow-violet-yellow).
- (✓) R19: 47 kΩ (yellow-violet-orange).
- (✓) R15: 10 kΩ (brown-black-orange).
- (✓) R8: 1000 Ω (brown-black-red).
- (✓) R13: 47 Ω (yellow-violet-black).
- (✓) R14: 100 Ω (brown-black-brown).
- (✓) R12: 1000 Ω (brown-black-red).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.



## CONTINUE

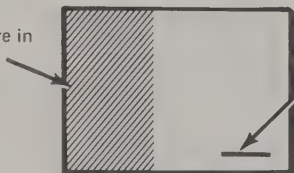
NOTE: To install an IC socket be sure the socket pins are straight. Then insert the socket pins and solder them to the foil.



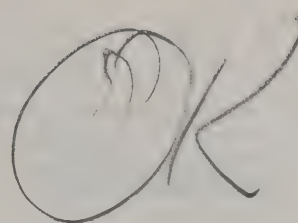
- (✓) 14-pin IC socket at IC2.
- (✓) R25: 1 MΩ (brown-black-green).
- (✓) R23: 470 kΩ (yellow-violet-yellow).
- (✓) R24: 82 kΩ (gray-red-orange).
- (✓) R21: 82 kΩ (gray-red-orange).
- (✓) R9: 1200 Ω (brown-red-red).
- (✓) R7: 1000 Ω (brown-black-red).
- (✓) R6: 270 Ω (red-violet-brown).
- (✓) R5: 100 kΩ (brown-black-yellow).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-8

The steps performed in this Pictorial are in this area of the circuit board.



PART  
NUMBER



IDENTIFICATION  
DRAWING

## START

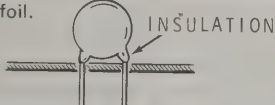
FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



- (✓) C87: 47 pF mica.
- (✓) C84: 130 pF mica.
- (✓) C81: 470 pF mica.
- (✓) C114: 270 pF mica.
- (✓) C82: 230 pF mica.
- (✓) C77: 680 pF mica.
- (✓) C78: 330 pF mica.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

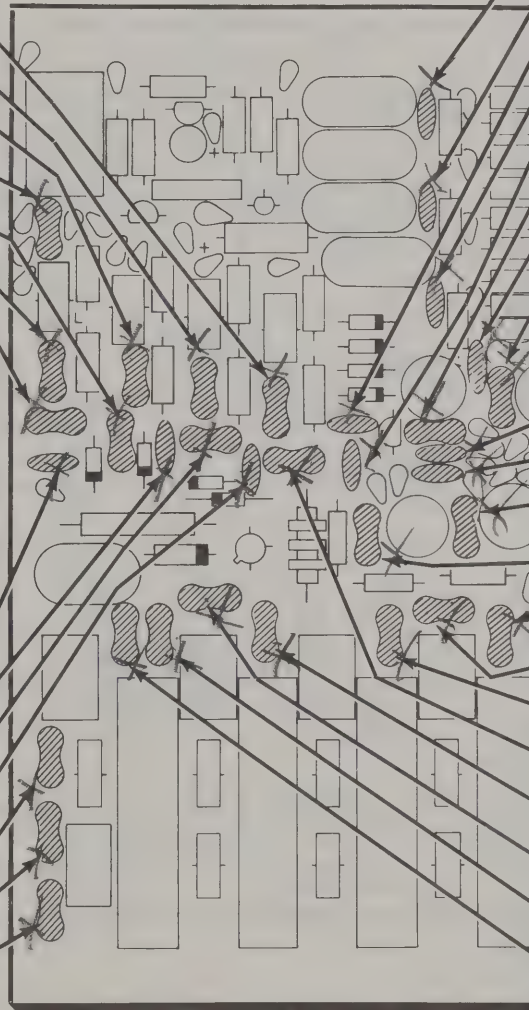
NOTE: When you install disc capacitors, do not push the insulated portions of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.



- (✓) C79: .05  $\mu$ F disc.
- (✓) C83: .05  $\mu$ F disc.
- (✓) C85: 130 pF mica.
- (✓) C86: .05  $\mu$ F disc.
- (✓) C96: 150 pF mica.
- (✓) C94: 270 pF mica.
- (✓) C97: 680 pF mica.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

## CONTINUE

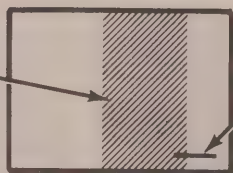
- (✓) C115: .05  $\mu$ F disc.
- (✓) C117: .05  $\mu$ F disc.
- (✓) C89: .05  $\mu$ F disc.
- (✓) C119: .05  $\mu$ F disc.
- (✓) C76: .05  $\mu$ F disc.
- (✓) C66: 150 pF mica.
- (✓) C122: .05  $\mu$ F disc.
- (✓) C64: 230 pF mica.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) C67: .05  $\mu$ F disc.
- (✓) C69: .05  $\mu$ F disc.
- (✓) C71: 47 pF mica.
- (✓) C68: 100 pF mica.
- (✓) C107: 100 pF mica.
- (✓) C108: 150 pF mica.
- (✓) C104: 75 pF mica.
- (✓) C88: 47 pF mica.
- (✓) C105: 200 pF mica.
- (✓) C98: 100 pF mica.
- (✓) C101: 100 pF mica.
- (✓) C102: 400 pF mica.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 2-9

OK

The steps performed in this Pictorial are in this area of the circuit board.



PART  
NUMBER

IDENTIFICATION  
DRAWING

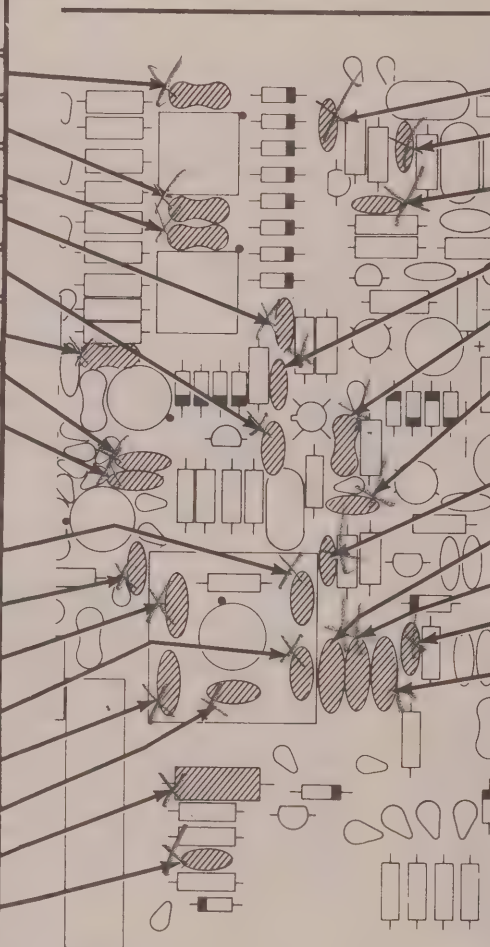
### START

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



- (✓) C116: 100 pF mica.
- (✓) C118: 130 pF mica.
- (✓) C121: 47 pF mica.
- (✓) C58: .05  $\mu$ F disc.
- (✓) C73: 3.3 pF disc.
- (✓) C123: 24 pF mica.
- (✓) C65: .05  $\mu$ F disc.
- (✓) C72: .05  $\mu$ F disc.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) C47: 6.8 pF disc.
- (✓) C75: .05  $\mu$ F disc.
- (✓) C51: 56 pF disc.
- (✓) C54: 3.3 pF disc.
- (✓) C49: 56 pF disc.
- (✓) C48: 27 pF disc.
- (✓) C53: 4.7 pF ceramic.
- (✓) C55: 6 pF disc.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

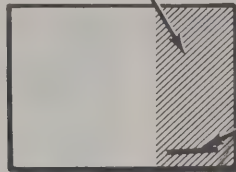


### CONTINUE

- (✓) C125: 5 pF disc.
- (✓) C126: 10 pF disc.
- (✓) C127: 3.3 pF disc.
- (✓) C63: .05  $\mu$ F disc.
- (✓) C61: 100 pF mica.
- ( ) C62: .05  $\mu$ F disc.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) C52: .05  $\mu$ F disc.
- (✓) C44: 510 pF disc.
- (✓) C45: 510 pF disc.
- (✓) C56: .05  $\mu$ F disc.
- (✓) C46: 510 pF disc.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-10

The steps performed in this Pictorial are in this area of the circuit board



IDENTIFICATION  
DRAWING

PART  
NUMBER

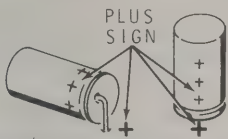
CONTINUE

START

(✓) C43: .05  $\mu$ F disc.

(✓) C109: .022  $\mu$ F Mylar.

NOTE: When you install an electrolytic capacitor, always connect the lead at the positive (+) end of the capacitor to the positive (+) marked point on the circuit board.



(✓) C42: 2  $\mu$ F electrolytic.

(✓) C38: 2  $\mu$ F electrolytic.

(✓) C128: .05  $\mu$ F disc.

(✓) C59: .05  $\mu$ F disc.

(✓) C57: .05  $\mu$ F disc.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

(✓) C23: .05  $\mu$ F disc.

(✓) C21: .05  $\mu$ F disc.

(✓) C17: .05  $\mu$ F disc.

(✓) C14: .05  $\mu$ F disc.

(✓) C1: 68 pF mica.

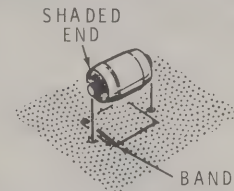
(✓) C4: 68 pF mica.

(✓) C2: .05  $\mu$ F disc.

(✓) C5: .05  $\mu$ F disc.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

NOTE: In the following four steps, be sure you position each capacitor so its shaded end is toward the banded end of the outline on the circuit board, as shown.



(✓) C36: 1000 pF polystyrene.

(✓) C37: 1000 pF polystyrene.

(✓) C34: 1800 pF polystyrene.

(✓) C35: 1800 pF polystyrene.

(✓) C29: .05  $\mu$ F disc.

(✓) C28: .05  $\mu$ F disc.

(✓) C25: 10 pF disc.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

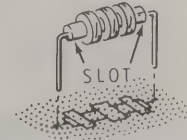
(✓) C15: 47 pF mica.

(✓) C18: 75 pF mica.

(✓) C13: .05  $\mu$ F disc.

(✓) C12: 3.3 pF disc.

(✓) RFC1: 350  $\mu$ H choke (#45-82).  
CAUTION: Bend the leads toward the slot in the core.



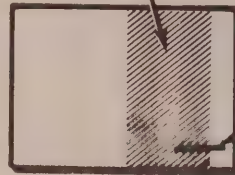
(✓) C11: .05  $\mu$ F disc.

(✓) C8: .05  $\mu$ F disc.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-11

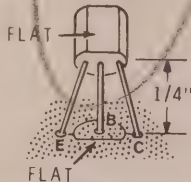
The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION  
DRAWING

## START

NOTE: When you install a transistor, line up the flat or tab on the transistor with the outline of the flat or tab on the circuit board. Then insert the leads in the corresponding holes in the circuit board. Position it 1/4" above the circuit board; then solder the leads to the foil and cut off the excess lead lengths.



(✓) Q6: MPS-6521 transistor (#417-172).

Install two MPS-A20 transistors (#417-801).

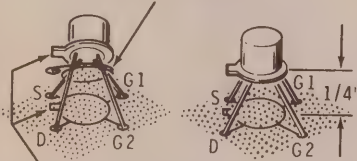
(✓) Q14.

(✓) Q7.

(✓) Q5: MPS-A20 transistor (#417-801).

(✓) Q4: 40673 transistor (#417-240).

MAY OR MAY NOT  
HAVE A  
SHORTING WIRE

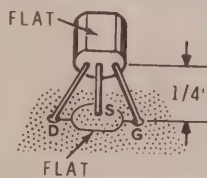


LOCATING TAB

(✓) If the transistor just installed has a shorting wire, as shown in the above drawing, remove it from the transistor leads.

(✓) Q3: MPS-A20 transistor (#417-801).

(✓) Q1: MPF-105 transistor (#417-169).

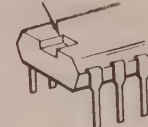


(✓) Q2: MPF-105 transistor (#417-169).

## CONTINUE

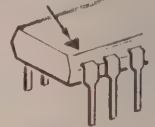
NOTE: The indexed (pin 1) end of inline integrated circuits may be marked in a number of ways such as a notch, triangle, dot, the numeral 1, etc.

### NOTCH



PIN 1

### TRIANGLE



PIN 1

### SMALL INDENTATION OR DOT



PIN 1

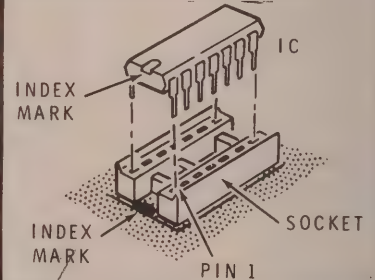
### RIDGE



PIN 1

Be sure you install the IC so its indexed end is toward the index mark printed on the circuit board.

Before you apply downward pressure to an IC, make sure each IC pin is centered in its proper socket hole. Handle IC's with care as their pins are very easily bent.



(✓) IC2: LM3900 integrated circuit (#442-71).

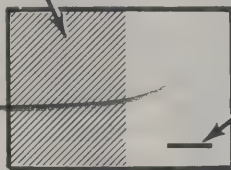
IC1: MC1496G integrated circuit (#442-96). Line up the tab on the IC with the outline of the tab on the circuit board; then insert the leads in their respective holes, 1 through 10, on the circuit board. Solder the leads to the foil and cut off the excess lead lengths.

### LOCATING TAB



PICTORIAL 2-12

The steps performed in this Pictorial are in this area of the circuit board.



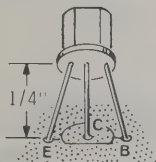
PART  
NUMBER

IDENTIFICATION  
DRAWING

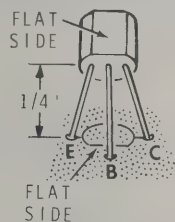
## START

(✓) Q12: MPS-A20 transistor (#417-801).

(✓) Q13: X29A829 transistor (#417-201).

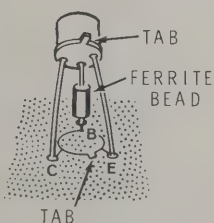


(✓) Q11: S2091 transistor (#417-116).



(✓) Q8: MPS6521 transistor (#417-172).

(✓) Q9: 2N4427 transistor (#417-880). Place a ferrite bead on the B (base) lead. Then mount the transistor as shown.



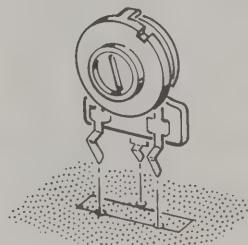
## CONTINUE

NOTE: When you install an electrolytic capacitor, always connect the lead at the positive (+) end of the capacitor to the positive (+) marked point on the circuit board.



(✓) C92: 10  $\mu$ F electrolytic.

(✓) R68: 50 k $\Omega$  control (#10-222).



(✓) C91: 2  $\mu$ F electrolytic.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-13

The steps performed in this Pictorial are in this area of the circuit board.

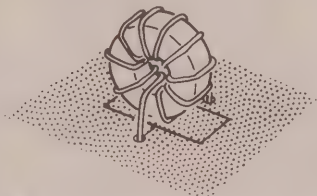
**START** ➔

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



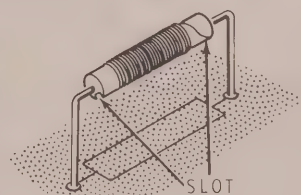
NOTE: When you install a coil in the following steps, keep it within the outline on the circuit board. Solder the leads to the foil and cut off the excess lead lengths as each coil is installed.



(✓) 9  $\mu$ H coil (#40-1797) at L22.

(✓) 4.2  $\mu$ H coil (#40-1798) at L23.

( ) 26  $\mu$ H choke (#45-62) at RFC3. Bend the leads toward the slot as shown.



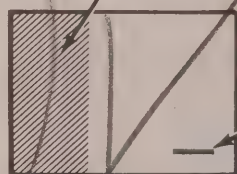
(✓) C93: .47  $\mu$ F Mylar.

( ) Solder the leads to the foil and cut off the excess lead lengths.

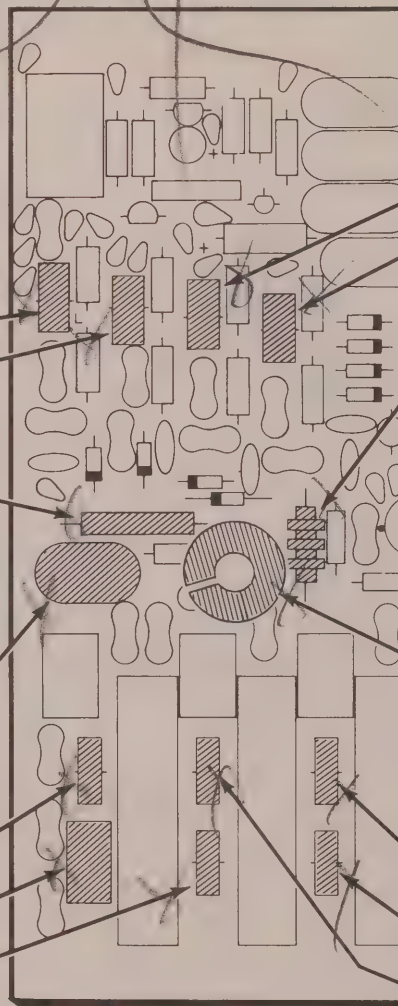
(✓) L26: 15.5  $\mu$ H coil (#40-1882).

(✓) L27: 27.5  $\mu$ H coil (#40-1791).

(✓) L29: 7  $\mu$ H coil (#40-1726).



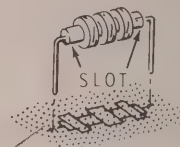
IDENTIFICATION DRAWING

**CONTINUE** ➔

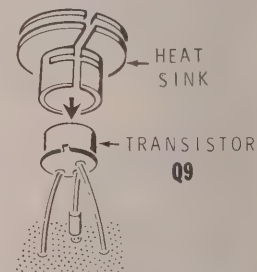
(✓) L24: 1.8  $\mu$ H coil (#40-1792).

(✓) L25: 1.3  $\mu$ H coil (#40-1800).

(✓) RFC2: 350  $\mu$ H choke (#45-82). CAUTION: Bend the leads toward the slot in the core.



(✓) Place heat sink (#215-45) on transistor Q9 as shown.



(✓) L31: 2.5  $\mu$ H coil (#40-1609).

(✓) L32: 2.5  $\mu$ H coil (#40-1609).

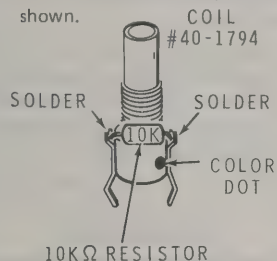
( ) L28: 7  $\mu$ H coil (#40-1726).

PICTORIAL 2-14

# START

(✓) Locate a 10 k $\Omega$  (brown-black-orange) resistor, and coil #40-1794.

(✓) Refer to the following drawing and solder the 10 k $\Omega$  resistor between the lugs of the coil. NOTE: Be sure you mount the resistor so the color dot on the coil is positioned as shown.



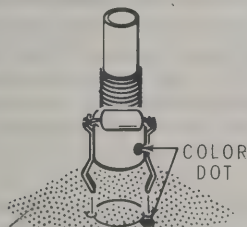
10K $\Omega$  RESISTOR

## NOTES:

1. In the following steps, be sure you position the color dot on the coil toward the dot of the coil outline on the circuit board.

2. Solder the pins to the foil as you install each part.

(✓) L13/R50: Mount the coil-resistor combination at L13.

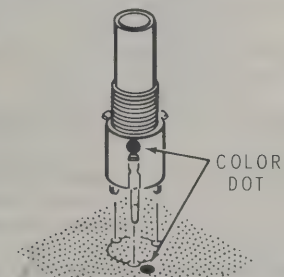


(✓) L14: 4  $\mu$ H coil (#40-1795).

(✓) L15: 1.3  $\mu$ H coil (#40-1796).

(✓) L16: 1.3  $\mu$ H coil (#40-1796).

(✓) L9: 5  $\mu$ H coil (#40-1802).

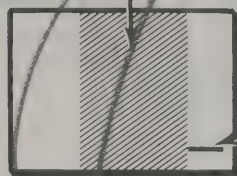


(✓) L33: 1.3  $\mu$ H toroid coil (#40-1800).

(✓) L34: 1.3  $\mu$ H toroid coil (#40-1800).

(✓) Solder the leads to the foil and cut off the excess lead lengths.

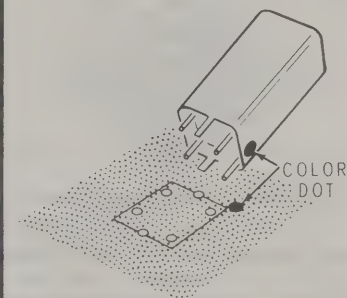
The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION DRAWING

# CONTINUE

(✓) L17/L18: 80/40 meter heterodyne oscillator coil (#40-1803).



(✓) L19/L21: 20/15 meter heterodyne oscillator coil (#40-1804).

(✓) L12: 15  $\mu$ H toroid coil (#40-1050). Match the color dot on the wide space on the circuit board.



(✓) L11: 15  $\mu$ H toroid coil (#40-1050).

(✓) Be sure the shield cans of coils L17, L18, L19, and L21 do not touch the leads of the resistors at the left side of the coils. If necessary, use a small screwdriver and very carefully press the bottom edge of each shield just far enough away from the resistor leads so they do not touch.

PICTORIAL 2-15

The steps performed in this Pictorial are in this area of the circuit board.

**START** ➡

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN. WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.

NOTE: When you install a coil in the following steps, keep it within the coil outline on the circuit board. Solder the leads to the foil and cut off the excess lead lengths.



(✓) L8: 1.3  $\mu$ H toroid coil (#40-1800).

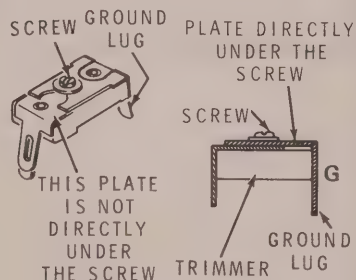
(✓) L7: 1.8  $\mu$ H toroid coil (#40-1792).

(✓) L6: 4.2  $\mu$ H toroid coil (#40-1798).

(✓) L5: 15.5  $\mu$ H toroid coil (#40-1882).

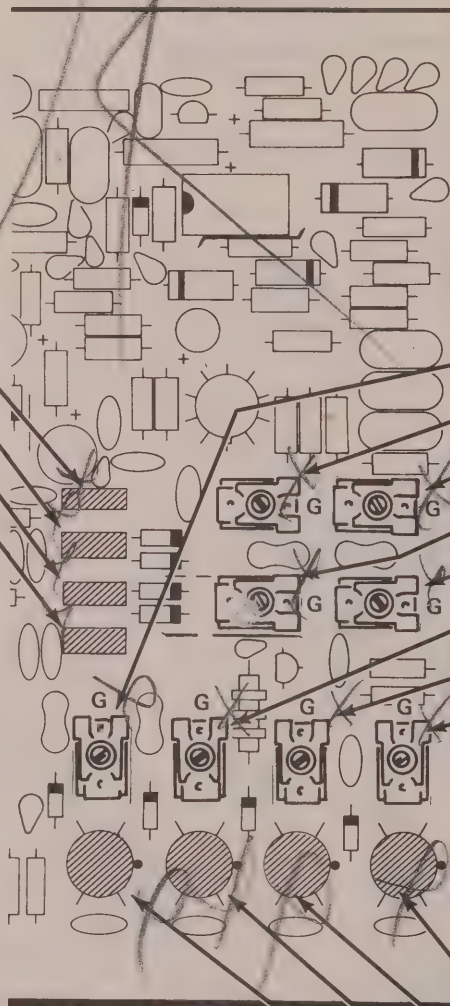
**NOTES:**

1. You will install four trimmer capacitors on the circuit board in the following steps. Note that there are two different values of trimmers.
2. Some of the trimmer lugs have two or more leaves. When you install the trimmers, make sure all of the lug leaves go through the circuit board.
3. IT IS VERY IMPORTANT to solder the correct trimmer lug to the correct foil. One lug on each trimmer will be called the ground lug (G). This is the lug that is connected to the metal plate directly under the screw on the trimmer.



PART  
NUMBER

IDENTIFICATION  
DRAWING

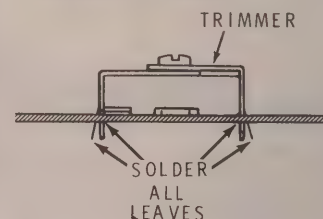


PICTORIAL 2-16

**CONTINUE** ➡

NOTES: (cont'd.)

4. Make sure that each trimmer capacitor is properly positioned and soldered to the foil. If a trimmer lug has more than one leaf, make sure all leaves are soldered.



(✓) C3: 8-60 pF trimmer (#31-52).

(✓) C24: 8-60 pF trimmer (#31-52).

(✓) C22: 8-60 pF trimmer (#31-52).

(✓) C19: 4-40 pF trimmer (#31-54).

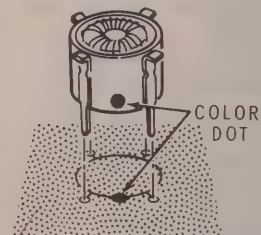
(✓) C16: 4-40 pF trimmer (#31-54).

(✓) C6: 4-40 pF trimmer (#31-54).

(✓) C7: 8-60 pF trimmer (#31-52).

(✓) C9: 8-60 pF trimmer (#31-52).

Install four toroid coils as shown below.



(✓) L4: 1.8  $\mu$ H toroid coil (#40-1788).

(✓) L3: 1.8  $\mu$ H toroid coil (#40-1788).

(✓) L2: 4.7  $\mu$ H toroid coil (#40-1787).

(✓) L1: 13  $\mu$ H toroid coil (#40-1786).

(✓) Solder the lugs to the foil.

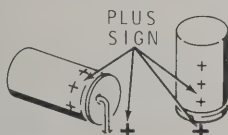
The steps performed in this Pictorial are in this area of the circuit board.

PART  
NUMBER  
  
IDENTIFICATION  
DRAWING

## START

Note the different position of the circuit board in this Pictorial.

NOTE: When you install an electrolytic capacitor, always connect the lead at the positive (+) end of capacitor to the positive (+) marked point on the circuit board.



(✓) C41: 100  $\mu$ F electrolytic.

(✓) C32: 100  $\mu$ F electrolytic.

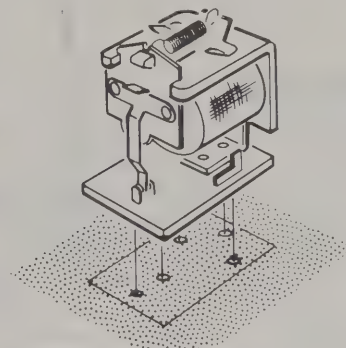
(✓) C33: 10  $\mu$ F electrolytic.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

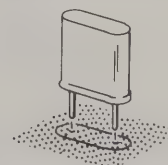
## CONTINUE

NOTE: In the following five steps, solder the pins to the foil as you install each part.

(✓) RY1: Relay (#69-47). CAUTION: Do not bend any of the mechanical parts on the relay.



(✓) Y1: 12.395 MHz crystal (#404-207).



(✓) Y2: 15.895 MHz crystal (#404-208).

(✓) Y3: 22.895 MHz crystal (#404-209).

(✓) Y4: 29.895 MHz crystal (#404-210).

Install eight .1  $\mu$ F Mylar capacitors.

(✓) C74.

(✓) C112.

(✓) C111.

(✓) C113.

(✓) C27.

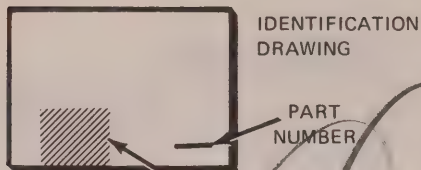
(✓) C26.

(✓) C31.

(✓) C39.

( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-17



The steps performed in this Pictorial are in this area of the circuit board.

## START

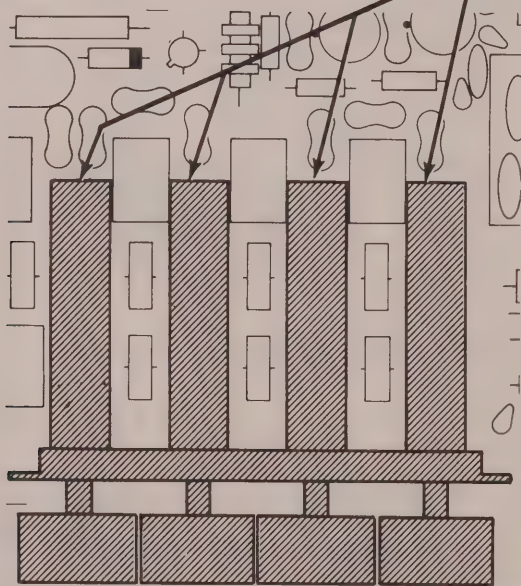
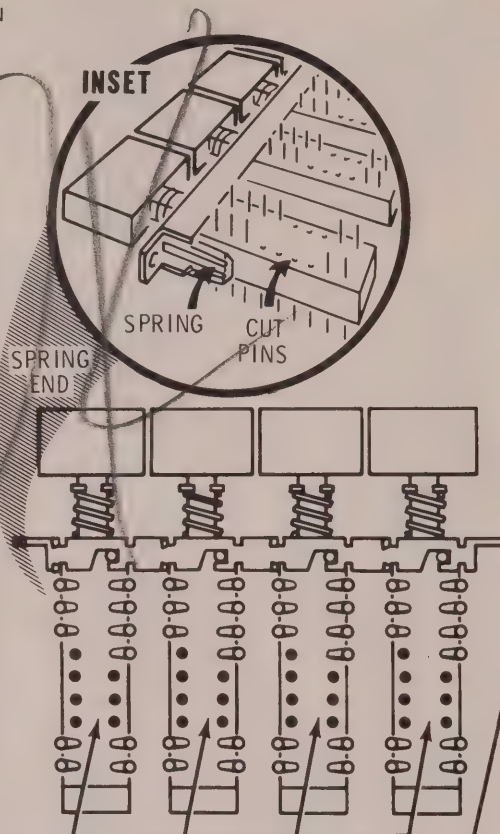
**FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.**

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.

**NOTE:** There is a spring at one end of the pushbutton switch assembly. (See inset drawing.) When you perform the next two steps, be sure you position the switch assembly so its spring end is toward your left as shown.

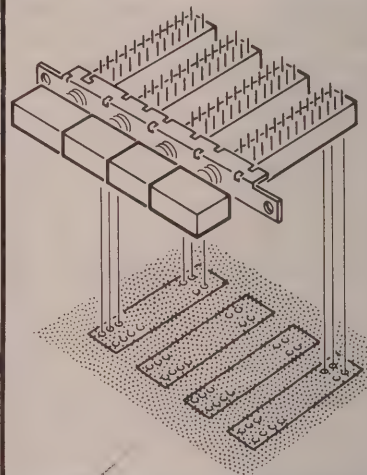
(✓) Position the pushbutton switch assembly so its spring end is toward your left as shown in Detail 2-18A.

(✓) Very carefully cut the indicated pins off each of the four switches. Cut them as close as possible to the body of each switch.



## CONTINUE

(✓) Turn the switch assembly over and line up the remaining pins with their respective holes in the circuit board.



(✓) Start the pins into the circuit board holes. Then press the switch assembly tight against the circuit board. Also, make sure the assembly is parallel with the circuit board. Then turn the assembly over and solder two lugs on each end of the switch assembly. Check the switch assembly to make sure it is straight. If the assembly is straight, solder the other switch lugs. Cut off the excess lugs from the foil side of the board.

## CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

- (✓) Unsoldered connections.
- (✓) "Cold" solder connections.
- (✓) Solder bridges between foil patterns.
- (✓) Protruding leads which could touch together.
- ( ) Transistors for the proper type and installation.
- (✓) Electrolytic capacitors for the correct position of the positive (+) end.
- (✓) Diodes for the correct position of the banded end.

## FINISH

## CIRCUIT BOARD WIRING

### NOTES:

1. In the following steps, you will use the 5-wire cable supplied with the kit to prepare four multiwire cables. Each cable will be connected to the circuit board as soon as it is prepared.

**CAUTION:** When you prepare a multiwire cable in the following steps, grip the cable securely when you remove insulation from one of the wires. This will prevent you from pulling one of the wires out of the cable.

2. When you prepare the ends of the cable wires, cut each wire to the length indicated in the appropriate Detail and remove 1/4" of insulation from each end of each wire. Then twist the strands and apply a small amount of solder to the wire ends to hold the strands together.
3. Solder each wire to the foil as it is connected to the circuit board. Then cut off the excess wire lengths.

Refer to Pictorial 3-1 in the Illustration Booklet for the following steps.

- ( ) Refer to Detail 3-1A and prepare an 8" cable as shown.

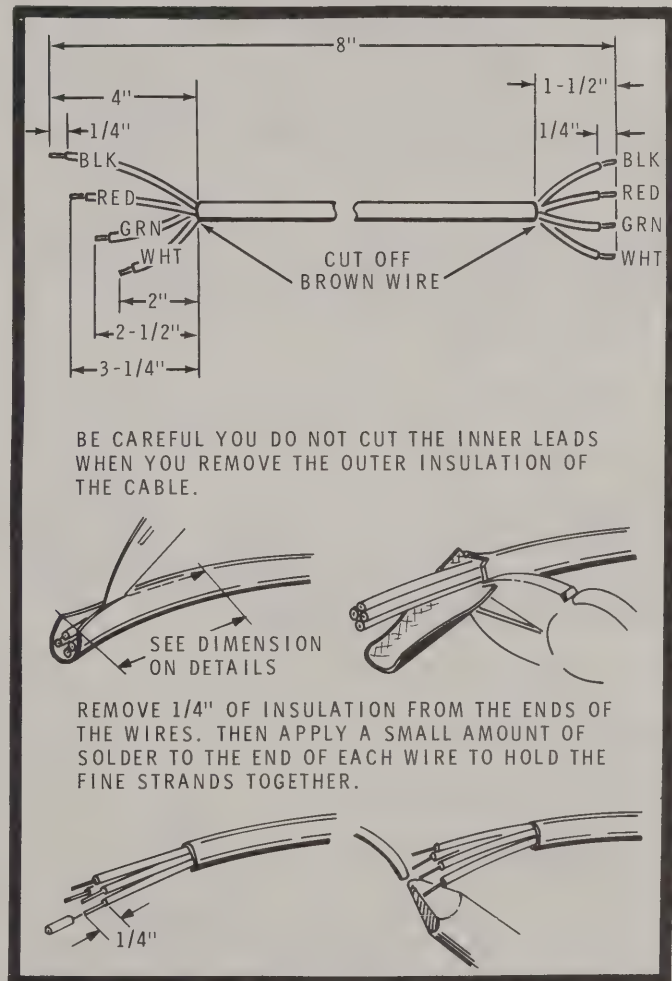
Connect the wires at the shorter prepared end of this cable to the following circuit board holes.

- ( ✓ ) White to hole NN  
( ✓ ) Green to hole MM  
( ✓ ) Red to hole LL  
( ✓ ) Black to hole KK

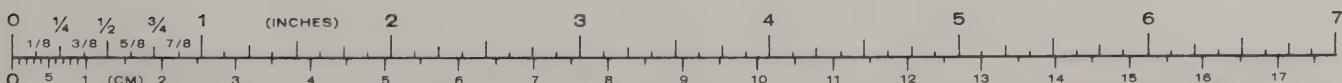
**NOTE:** In the following steps, (NS) means not to solder because another wire (or wires) will be added later. The letter S with a number, such as (S-2), means to solder the connection. The number that follows the letter S indicates the number of wires at that connection.

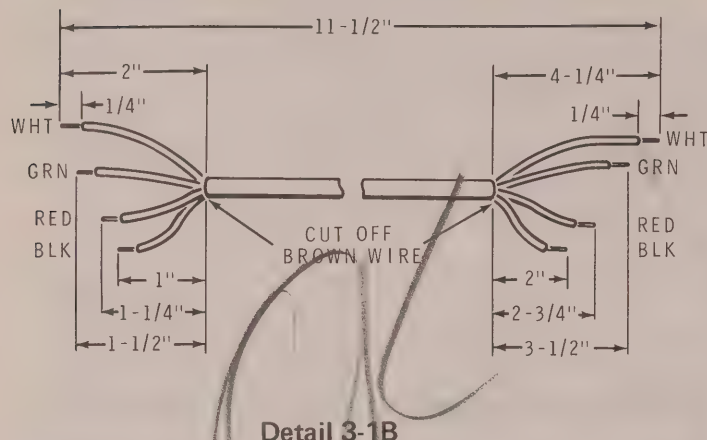
Connect the wires at the free end of the 8" cable to the pushbutton switch assembly as follows. Wrap each wire around the pin so it makes a secure mechanical connection before you solder the wire to the pin.

- ( ✓ ) White to switch SW4 pin 9 (NS).  
( ✓ ) Green to switch SW3 pin 9 (NS).  
( ✓ ) Red to switch SW2 pin 9 (NS).  
( ✓ ) Black to switch SW1 pin 9 (NS).



Detail 3-1A





- (✓) Refer to Detail 3-1B and prepare an 11-1/2" cable as shown.

Connect the wires at the shorter prepared end of the cable to the following circuit board holes.

- (✓) Black to hole N.
- ( ) Red to hole P.
- (✓) Green to hole Q.
- (✓) White to hole R.

At the other end of the cable, connect the wires to the pushbutton switch assembly as follows:

- (✓) Black to SW1 pin 5 (S-1).
- (✓) Red to SW2 pin 5 (S-1).
- (✓) Green to SW3 pin 5 (S-1).
- (✓) White to SW4 pin 5 (S-1).
- (✓) Cut an 8-1/2" length off the remaining length of 5-wire cable. Then carefully remove all of the outer insulation from the 8-1/2" length. These cable wires will be used in the following steps.

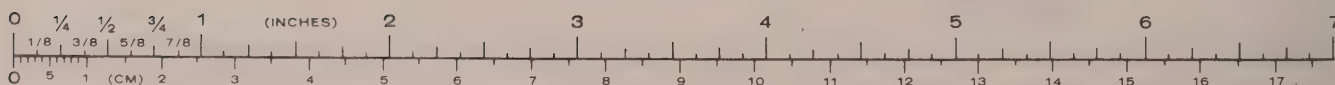
**NOTE:** When you prepare a stranded wire, cut it to the length specified in the step and remove 1/4" of insulation from each end. Then twist the strands and apply a small amount of solder to the wire ends to hold the strands together.

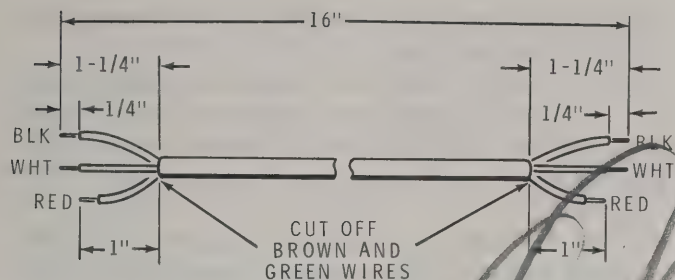
You may prefer to prepare wires ahead of time, as in the following step. The wires are listed in the order in which they are used. Save the remaining wires for use later.

- (✓) Prepare the following wires:

2-1/2" white	3-1/2" red
2-1/2" white	5" black
2-1/2" green	2-3/4" green

- (✓) Connect a 2-1/2" white wire between circuit board holes 4 (S-1) and 4 (S-1).
- (✓) Connect a 2-1/2" white wire from switch SW4 pin 9 (S-2) to circuit board hole 8 (S-1).
- (✓) Connect a 2-1/2" green wire from switch SW3 pin 9 (S-2) to circuit board hole 7 (S-1).
- (✓) Connect a 3-1/2" red wire from switch SW2 pin 9 (S-2) to circuit board hole 6 (S-1).
- (✓) Connect a 5" black wire from switch SW1 pin 9 (S-2) to circuit board hole 5 (S-1).
- (✓) Connect a 2-3/4" green wire between circuit board holes 3 (S-1) and 3 (S-1).
- (✓) Position the cable wires connected to the pushbutton switch assembly down between the switch pins and against the body of the switches. Position the circuit board wires as shown on the Pictorial.





Detail 3-1C

( ) Refer to Detail 3-1C and prepare a 16" cable. At one end of the cable, connect the wires to the following circuit board holes.

- (✓) Red to hole HH.
- (✓) Black to hole JJ.
- (✓) White to hole EE.

The other end of the cable will be connected later.

(✓) Refer to Detail 3-1D and prepare an 11" cable.

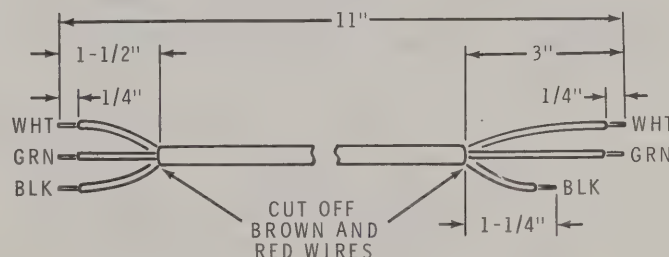
At the longer prepared end, connect the wires to the following circuit board holes.

- (✓) White to hole PP.
- (✓) Black to hole CC.

The green wire, and the wires at the other end of the cable, will be connected later.

NOTES:

1. When the hardware is called for in a step, only the screw size will be given. For instance, if 6-32 x 1/4" hardware is called for, it means to use a 6-32 x 1/4" screw, one or more #6 lockwashers, and a 6-32 nut. The Detail, inset drawing, or Pictorial referred to in the steps will show the proper number of lockwashers and the type of screw to use.
  2. Use the plastic nut starter supplied with the kit to hold and start 6-32 and 4-40 nuts on screws.
- (✓) Refer to the inset drawing on Pictorial 3-1 and mount an angle bracket (#204-1844) on the upper edge of the circuit board. Use 6-32 x 1/4" hardware at the three locations shown. Tighten the hardware only finger tight.
- (✓) Move the angle bracket as far as it will go away from the edge of the circuit board. Then tighten the screws.



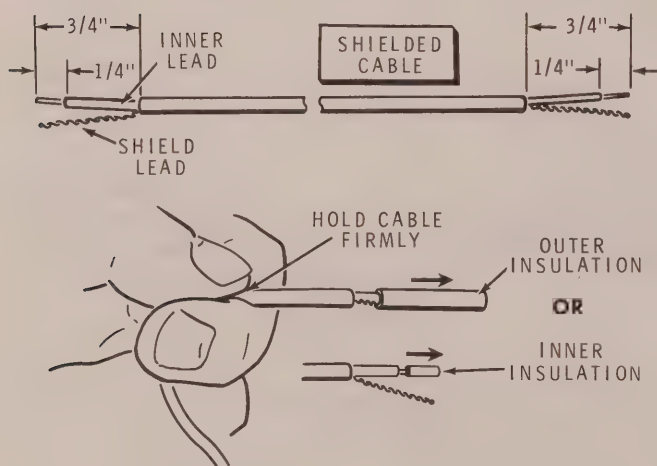
Detail 3-1D

Refer to Pictorial 3-2 in the Illustration Booklet for the following steps.

- (✓) Connect a 2-1/2" red wire between circuit board holes 2 (S-1) and 2 (S-1).
- (✓) Connect a 3-1/2" black wire between circuit board holes 1 (S-1) and 1 (S-1).

#### NOTES:

1. All of the shielded cables used in this kit will have their ends prepared and dimensioned as specified in Detail 3-2A. CAUTION: Hold each cable as shown when you prepare its ends. This will prevent you from pulling the inner lead out of the cable when you remove outer or inner insulation.
2. The step that directs you to prepare a shielded cable will specify its length.

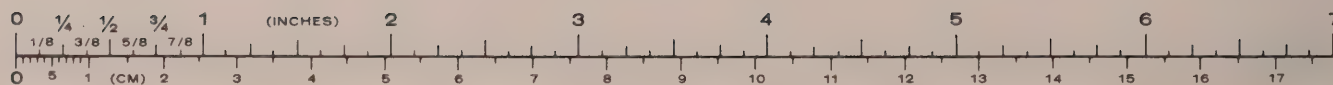


**Detail 3-2A**

- (✓) Refer to Detail 3-2A and prepare a 4" shielded cable.
- (✓) At one end of this cable, connect the shield lead to hole S (S-1) and the inner lead to hole C (S-1). NOTE: These two holes are near the center of the circuit board.
- (✓) At the other end of the cable, carefully cut off only the shield lead. Then connect the inner lead to hole H (S-1).
- (✓) Refer to Detail 3-2A and prepare four 7" shielded cables.
- (✓) At one end of a 7" shielded cable, wrap the inner lead around SW1 pin 3 (S-1) and the shield lead around pin 4 (S-1).

NOTE: Be very careful when you connect the shielded cables in the following steps. Do not allow the shield wires to touch adjacent coil or switch lugs. Position the leads down between the coils; then carefully wrap the leads around the coil lugs. Solder the leads to the lugs and cut off the excess lead lengths. CAUTION: Use only enough heat and solder to make a good connection.

- (✓) At the free end of the 7" cable, wrap the shield lead around coil L1 lug 2 (S-1) and the inner lead around lug 1 (S-1).
- (✓) At one end of another 7" cable, wrap the inner lead around SW2 pin 3 (S-1) and the shield lead around pin 4 (S-1).
- (✓) At the other end of the cable, wrap the shield lead around coil L2 lug 2 (S-1) and the inner lead around lug 1 (S-1).
- (✓) At one end of another 7" cable, wrap the inner lead around SW3 pin 3 (S-1) and the shield lead around pin 4 (S-1).
- (✓) At the other end of the cable, wrap the shield lead around coil L3 lug 2 (S-1) and the inner lead around lug 1 (S-1).



- (✓) At one end of another 7" cable, wrap the inner lead around SW4 pin 3 (S-1) and the shield lead around pin 4 (NS).
- (✓) At the other end of the cable, wrap the shield lead around L4 lug 2 (S-1) and the inner lead around lug 1 (S-1).
- (✓) Refer to Detail 3-2A and prepare a 5-1/2" shielded cable.
- (✓) At one end of the cable, wrap the inner lead around SW4 pin 2 (NS) and the shield lead around lug 4 (S-2). The other end of this cable will be connected later.
- (✓) Refer to Detail 3-2A and prepare a 13-1/2" shielded cable.
- (✓) At one end of this cable, connect the shield lead to the indicated circuit board hole S (S-1) and the inner lead to hole M (S-1). The other end of this cable will be connected later.
- (✓) Refer to Detail 3-2A and prepare a 7" shielded cable.
- (✓) At one end of this cable, connect the shield lead to the other circuit board hole marked S (S-1) and the inner lead to hole L (S-1). The other end of this cable will be connected later.
- (✓) Connect an 8-1/2" wire between circuit board holes J (S-1) and WW (S-1).
- (✓) Connect a 6-1/2" wire between circuit board holes V (S-1) and V (S-1).
- (✓) Install a 1-1/2" wire at the location marked JUMPER. NOTE: Position this wire over R22, the 470 kΩ (yellow-violet-yellow) resistor, as shown.
- (✓) Connect a 3-1/2" wire between circuit board holes U (S-1) and U (S-1).
- (✓) Connect a 10" wire between circuit board holes K (S-1) and B (S-1).
- (✓) Connect an 8" wire from circuit board hole XX (S-1) to switch SW1 pin 6 (NS).
- (✓) Connect a 4" wire from circuit board hole D (S-1) to switch SW4 pin 8 (NS).
- (✓) Connect a 2-1/2" wire from circuit board hole T (S-1) to SW4 pin 6 (NS).
- ( ) Prepare the following yellow wires:

Refer to Pictorial 3-3 in the Illustration Booklet for the following steps.

#### NOTES:

1. Use yellow hookup wire when you perform the following steps. After you connect a wire on the circuit board, solder the wire to the foil and cut off the excess wire lengths.
2. When you connect a wire to one of the pins of the pushbutton switch assembly, wrap the wire around the pin so it makes a secure mechanical connection before you apply any solder.

- (✓) Prepare the following wires:

8-1/2"	10"
6-1/2"	8"
1-1/2"	4"
3-1/2"	2-1/2"

2"	2-1/2"	2"
2"	2-1/2"	2"
2"	2-1/2"	2"

Connect wires between the pins of the pushbutton switch assembly as follows:

- (✓) 2" yellow from SW1 pin 8 (S-1) to SW2 pin 8 (NS).
- (✓) 2" yellow from SW2 pin 8 (S-2) to SW3 pin 8 (NS).
- (✓) 2" yellow from SW3 pin 8 (S-2) to SW4 pin 8 (S-2).
- (✓) 2-1/2" yellow from SW1 pin 6 (S-2) to SW2 pin 6 (NS).
- (✓) 2-1/2" yellow from SW2 pin 6 (S-2) to SW3 pin 6 (NS).
- (✓) 2-1/2" yellow from SW3 pin 6 (S-2) to SW4 pin 6 (S-2).

(✓) 2" yellow from SW4 pin 2 (S-2) to SW3 pin 2 (NS).

(✓) 2" yellow from SW3 pin 2 (S-2) to SW2 pin 2 (NS).

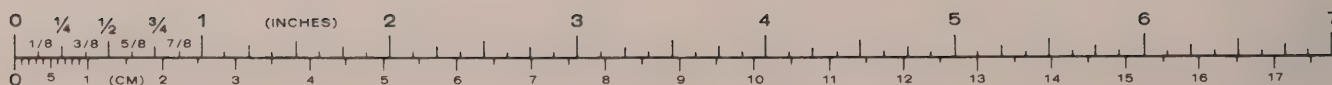
( ) 2" yellow from SW2 pin 2 (S-2) to SW1 pin 2 (S-1).

(✓) Group together all of the wires and cables at D on the Pictorial. Then refer to the inset drawing and, using a cable tie as shown, tie all of the wires and cables tightly together.

(✓) In a similar manner, use cable ties to securely tie together the wires and/or cables at E and F.

(✓) Position the wires on the circuit board as shown in the Pictorial.

This completes the circuit board wiring. Shake out any loose wire clippings or solder splashes. Recheck the circuit board for any solder bridges between adjacent foil patterns. Then set the circuit board aside until it is called for later.



# CHASSIS

## PARTS LIST

Check the remaining parts against the following list. Make a check (✓) in the space provided as you identify each part. The illustrations show what the part looks like. Only the hardware is shown actual size.

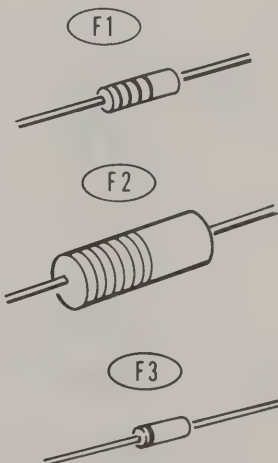
Some parts are packaged in containers with the part number marked on the outside. Except for the initial parts check, keep these parts in their containers so they can be easily identified when they are called for in the assembly steps.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with the kit. If one is not available, see "Replacement Parts" inside the rear cover of this Manual. Your Warranty is located inside the front cover. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

### RESISTORS-DIODES

F1	(✓)	2	1000 (brown-black-red) resistor.	1-9	R303, R304
F1	(✓)	1	47 k $\Omega$ (yellow-violet-orange) resistor.	1-25	R305
F2	(✓)	2	100 $\Omega$ , 2-watt (brown-black-brown) resistor	1-20-2	R306, R307
F3	(✓)	1	1N458 diode	56-24	D301



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
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## CAPACITORS

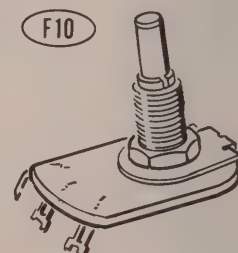
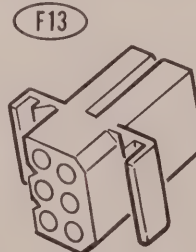
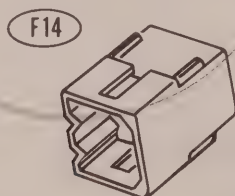
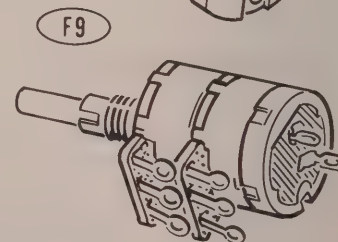
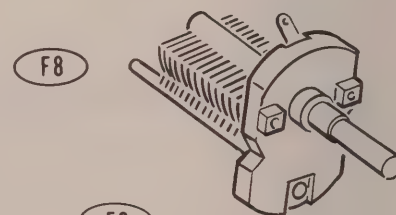
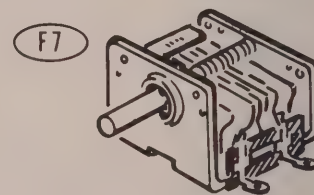
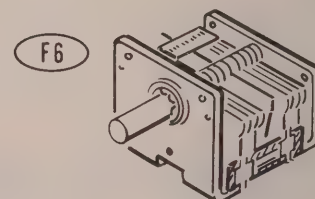
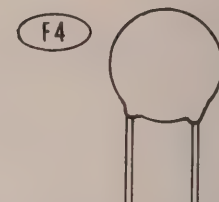
F4	(✓)	1	.05 $\mu$ F disc capacitor	21-143	C304
F5	(✓)	1	.47 $\mu$ F Mylar capacitor	27-86	C305
F6	(✓)	1	Preselector tuning capacitor	26-151	C301A/B
F7	(✓)	1	VFO tuning capacitor	26-152	C302A/B
F8	(✓)	1	Loading capacitor	26-154	C303

## CONTROL-SWITCH

F9	(✓)	1	10 k $\Omega$ /1000 $\Omega$ control with switch	14-17	R301, R302, S301
F10	(✓)	1	Rotary switch	63-3	SW302

## CONNECTOR-PIN-JACK-PLUG

F11	(✓)	2	Male connector pin	432-72	
F12	(✓)	2	Female connector pin	432-73	
F13	(✓)	1	Chassis connector	432-94	
F14	(✓)	1	Cable connector	432-95	
F15	(✓)	1	Antenna socket	434-107	J302
F16	(✓)	2	Antenna plug	438-4	
F17	(✓)	2	Jack	436-20	J301, J303



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
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## HARDWARE

NOTE: The hardware may be in more than one packet. Open all the hardware packets before you check the hardware against the Parts List.

### #4 Hardware

G1	( )	2	4-40 x 1/4" screw	250-52
G2	( )	2	4-40 x 1/2" flat head screw	250-322
G3	( )	2	4-40 nut	252-15
G4	( )	4	#4 lockwasher	254-9

### #6 Hardware

G5	( )	1	6-32 x 1/8" round head screw	250-208
G6	( )	4	6-32 x 1/8" setscrew	250-33
G7	( )	6	6-32 x 3/16" screw	250-138
G8	( )	4	6-32 x 1/4" screw	250-56
G9	( )	4	6-32 x 1/4" flat head screw	250-416
G10	( )	2	6-32 x 3/8" screw	250-89
G11	( )	15	#6 x 1/4" sheet metal screw	250-170
G12	( )	11	6-32 nut	252-3
G13	( )	16	#6 lockwasher	254-1
G14	( )	2	3/16" spacer	255-2
G15	( )	4	#6 solder lug	259-1

### Other Hardware

G16	( )	6	Control nut	252-7
G17	( )	4	Control flat washer	253-10
G18	( )	2	Fiber shoulder washer	253-16
G19	( )	3	Control lockwasher	254-5
G20	( )	1	Split bushing	455-11
G21	( )	1	8-32 x 3/8" setscrew	250-1193

G1



G2



G3



G4



G5



G6



G7



G8



G9



G10



G11



G12



G13



G14



G15



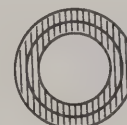
G16



G17



G18



G19



G20



G21



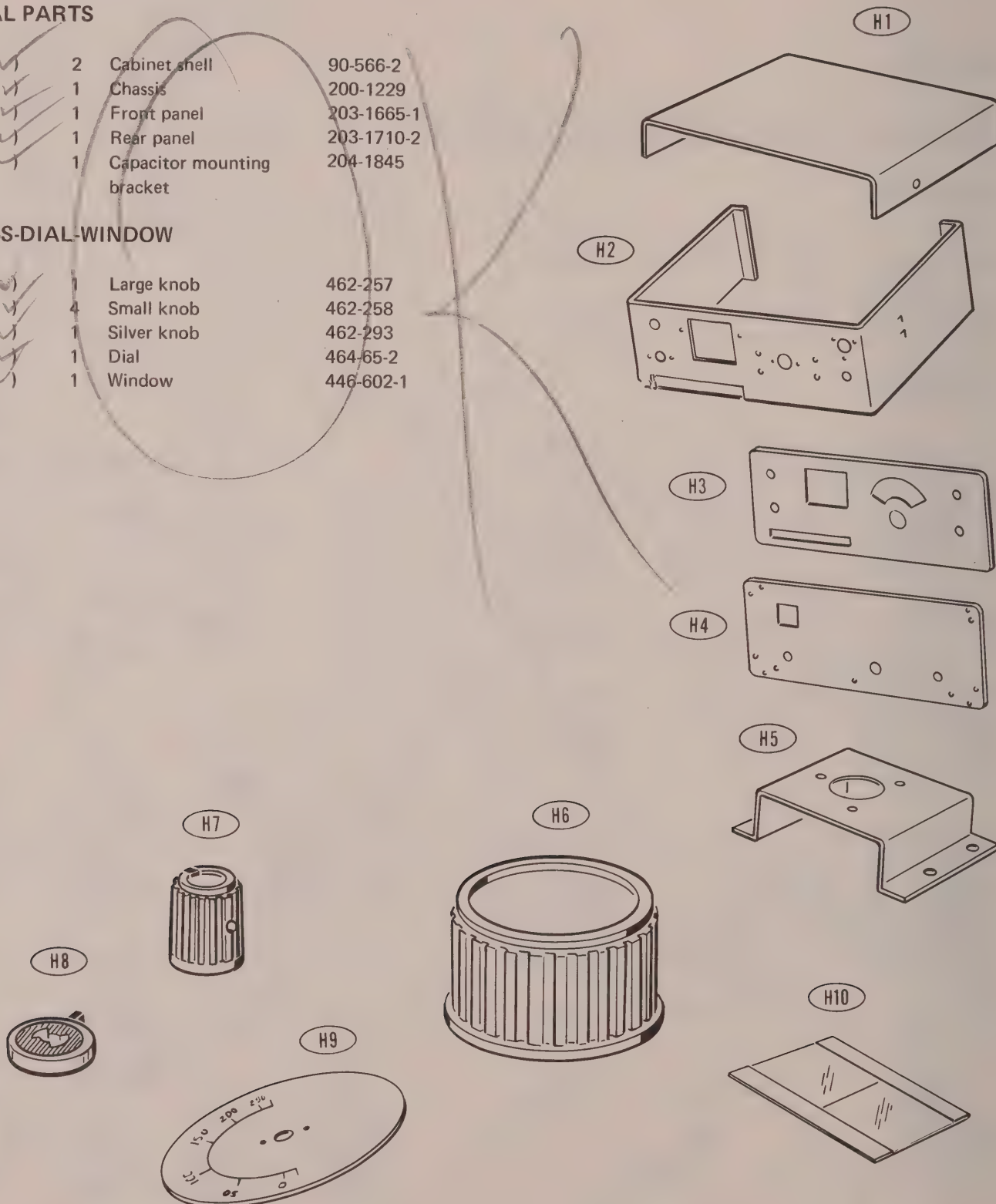
KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
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## METAL PARTS

H1	(✓)	2	Cabinet shell	90-566-2
H2	(✓)	1	Chassis	200-1229
H3	(✓)	1	Front panel	203-1665-1
H4	(✓)	1	Rear panel	203-1710-2
H5	(✓)	1	Capacitor mounting bracket	204-1845

## KNOBS-DIAL-WINDOW

H6	(✓)	1	Large knob	462-257
H7	(✓)	4	Small knob	462-258
H8	(✓)	1	Silver knob	462-293
H9	(✓)	1	Dial	464-65-2
H10	(✓)	1	Window	446-602-1

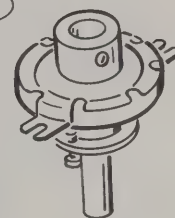


KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
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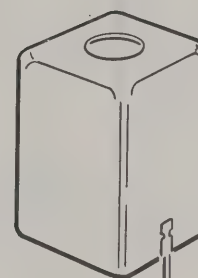
# MISCELLANEOUS

H11	(✓)	1	Vernier drive	100-1608
H12	(✓)	1	Coil shield	206-502
H13	(✓)	1	Meter	407-167
H14	(✓)	1	3-lug terminal strip	431-10
H15	(✓)	4	Plastic chassis nut	75-61
H16	(✓)	1	Alignment tool, small	490-109
H17	(✓)	1	Alignment tool, large	490-1
H18	( )	1	Metal blade	205-778
H19	(✓)	4	Plastic foot	261-34
	(✓)	5'	Red wire	344-3
	(✓)	5'	Black wire	344-2

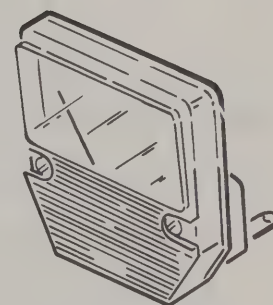
H11



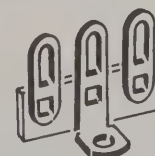
H12



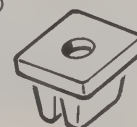
H13



H14



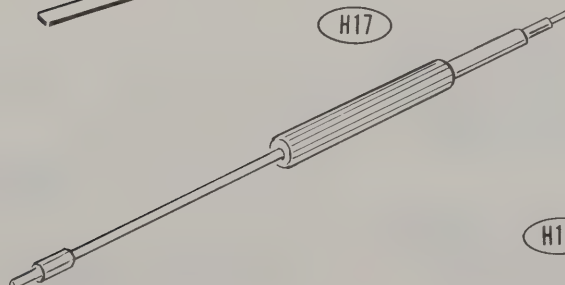
H15



H16



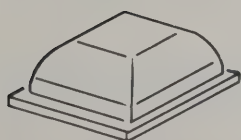
H17



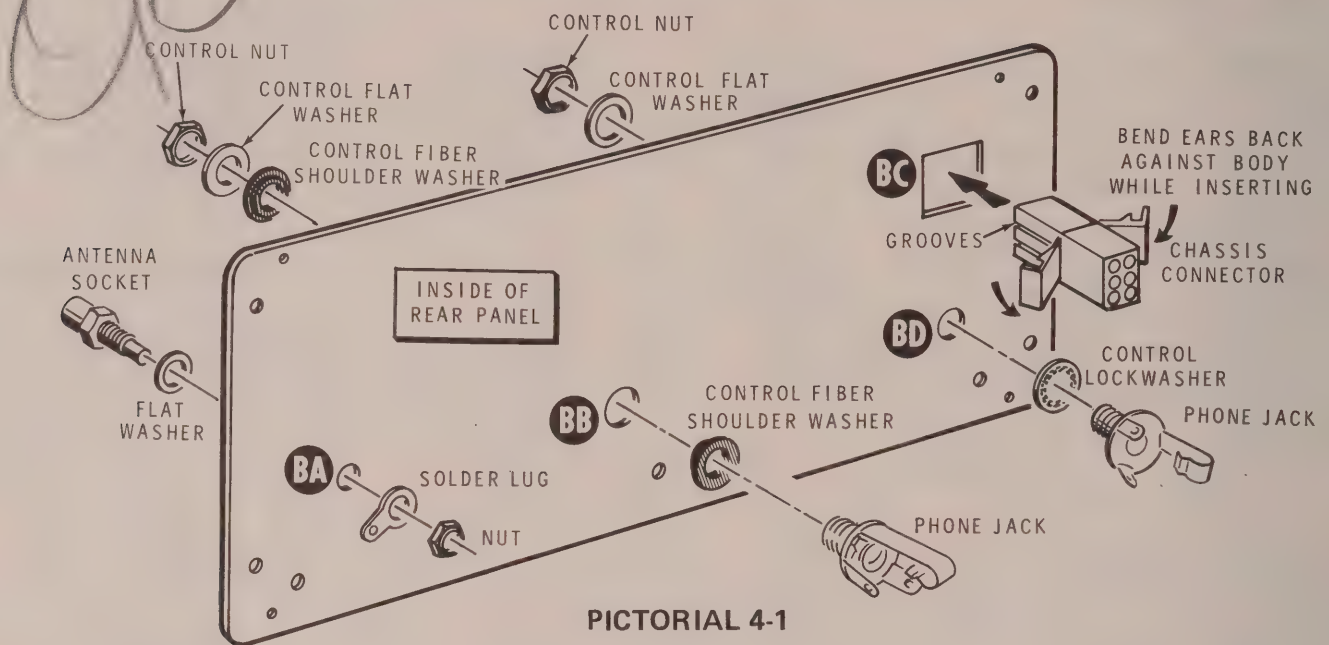
H18



H19



## STEP-BY-STEP ASSEMBLY



### REAR PANEL PARTS MOUNTING

Refer to Pictorial 4-1 for the following steps.

- (✓) Install an antenna socket in hole BA with the hardware supplied with the socket. Position the lug as shown; then bend it away from the panel. CAUTION: Do not overtighten the hardware, as you could break the socket.
- (✓) Install a phone jack in hole BB with two fiber shoulder washers, a control flat washer, and a control nut. Position the jack as shown in the Pictorial. CAUTION: Be sure the shoulders of the fiber washers are properly seated in the panel before you tighten the hardware.
- (✓) Install a phone jack in hole BD with a control lockwasher, control flat washer, and control nut. Position the jack as shown in the Pictorial. Also, note the difference in position between this jack and jack BB.
- (✓) Install the chassis connector in hole BC. CAUTION: Be sure you install it so its grooves are positioned as shown in the Pictorial.

### MOUNTING AND WIRING REAR PANEL

Refer to Pictorial 4-2 in the Illustration Booklet for the following steps.

- (✓) Mount the rear panel assembly to the angle bracket on the circuit board with #6 x 1/4" sheet metal screws at the three indicated locations.

- ( ) Prepare the following yellow wires:

1-1/2"	4"
1-1/4"	4"
3-1/2"	3-1/2"
7"	2"

Connect wires from the circuit board to the parts on the rear panel as follows:

- (✓) 1-1/2" yellow wire from hole X (S-1) to socket BA lug 1 (S-1).
- (✓) 1-1/4" yellow wire from relay RY1 lug 2 (S-1) to socket BA lug 2 (S-1).

## NOTES:

1. If you use a keyer such as the Heathkit Model HD-1410, wire jack BB as directed in steps 1, 2, and 3, as shown in inset drawing #1 on Pictorial 4-2. Then disregard steps 4, 5, and 6.
2. If you intend to use a Heathkit Model HD-10 Keyer, disregard steps 1, 2, and 3. Then wire jack BB as directed in steps 4, 5, and 6, and as shown in inset drawing #2 on Pictorial 4-2.
3. You can use a "straight" key with both wiring options.

(✓) 1. 3-1/2" yellow wire from hole W (S-1) to jack BB lug 2 (NS).

(✓) 2. 7" yellow wire from hole AA (S-1) to jack BB lug 2 (S-2).

(✓) 3. 4" yellow wire from hole Y (S-1) to jack BB lug 1 (S-1).

— OR —

( ) 4. 3-1/2" yellow wire from hole W (S-1) to jack BB lug 1 (NS).

( ) 5. 7" yellow wire from hole AA (S-1) to jack BB lug 1 (S-2).

( ) 6. 4" yellow wire from hole Y (S-1) to jack BB lug 2 (S-1).

(✓) Refer to the inset drawing on Pictorial 4-2 and install a female connector pin (#432-73) on one end of a 4" yellow wire.

(✓) Insert the connector pin into chassis connector BC hole 3. Push in on the pin until it locks in place in the chassis connector.

(✓) Connect the free end of the 4" yellow wire to circuit board hole Z (S-1).

(✓) Connect a 3-1/2" yellow wire from circuit board hole BB (S-1) to jack BD lug 2 (NS).

( ) Connect a 2" yellow wire from hole DD (S-1) to jack BD lug 1 (NS).

## MOUNTING PANEL/CIRCUIT BOARD ASSEMBLY

Refer to Pictorial 4-3 in the Illustration Booklet for the following steps.

(✓) Refer to inset #1 on the Pictorial and press plastic chassis nuts into both holes at CA in the right side of the chassis.

(✓) In the same manner, press plastic chassis nuts into both holes at DA in the other side of the chassis.

(✓) Install 6-32 x 3/8" hardware into chassis holes AB and AD in the front of the chassis.

CAUTION: When you perform the following steps, be sure you position the front edge of the circuit board ABOVE the flange on the front of the chassis as shown in the inset drawing on the Pictorial.

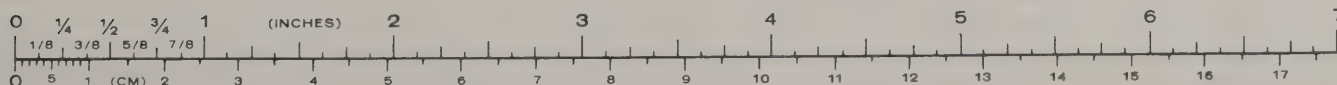
(✓) Spring the chassis sides outward slightly; then install the panel/circuit board assembly inside the chassis. Be careful you do not pinch any wires when you insert the knobs of the pushbutton switch assembly through the opening in the front of the chassis.

(✓) Check the operation of each pushbutton switch. Reposition any wires that interfere with proper operation.

(✓) Be sure the front edge of the circuit board is above the chassis flange; then loosely secure the rear panel to the chassis with #6 x 1/4" sheet metal screws at the four indicated locations.

(✓) Carefully push the cables and wires away from the front of the chassis so the mounting holes in the front edge of the circuit board are exposed.

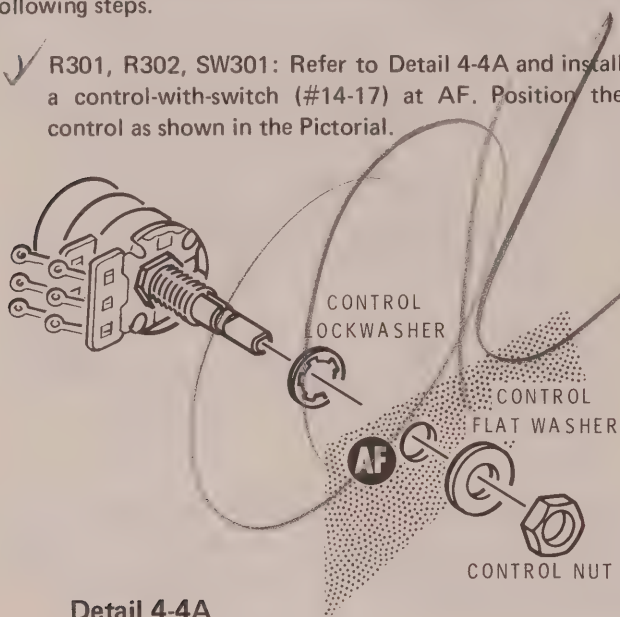
(✓) Secure the front edge of the circuit board to the flange with 6-32 x 1/4" hardware. Then tighten the four screws in the rear panel.



## CHASSIS PARTS MOUNTING AND WIRING

Refer to Pictorial 4-4 in the Illustration Booklet for the following steps.

- (✓) R301, R302, SW301: Refer to Detail 4-4A and install a control-with-switch (#14-17) at AF. Position the control as shown in the Pictorial.



Detail 4-4A

NOTE: Inset drawing #1 on Pictorial 4-4 is a "blow-up" of the wiring of control AF. Refer to both inset drawing #1 and Pictorial 4-4 when you perform the following ten steps.

Connect the black, green, and white wires of the cable marked X on the Pictorial to control AF as follows:

1. (✓) White to lug 6 (S-1).
2. (✓) Green to lug 5 (S-1).
3. (✓) Black to lug 4 (NS).

NOTE: Protruding from cable-tie F are the free ends of two shielded cables. Connect these cables as directed in the following steps.

4. (✓) At the free end of the shielded cable coming from cable-tie F and switch SW4, connect the inner lead to control AF lug 2 (S-1) and the shield lead to lug 1 (NS).
5. (✓) At the free end of the other shielded cable coming from cable-tie F, connect the inner lead to control AF lug 3 (S-1) and the shield lead to lug 1 (NS).

6. (✓) Remove all of the insulation from a 2" length of yellow wire.

7. (✓) Insert one end of this bare wire through control AF lug 1 (NS); then on to lug 4 (NS).

NOTE: When a wire passes through a connection and goes to another point, as in the preceding step, it will count as two wires in the solder instruction, one entering and one leaving the connection. When you solder this type connection, be sure you use enough solder and heat to properly solder the "through wire" and all other wires at the connection.

8. (✓) Solder all of the wires at control AF lug 1 (S-4). Position the free end of the wire out of the way for connection later.

9. (✓) Cut both leads of a .47  $\mu$ F Mylar capacitor to 3/4".

10. (✓) C305: Connect the prepared .47  $\mu$ F capacitor between control AF lugs 4 (S-3) and 8 (NS).

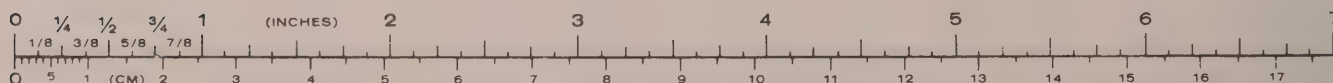
- (✓) Refer to inset drawing #2 on the Pictorial and install a female connector pin (#432-73) on one end of an 8-1/2" yellow wire.

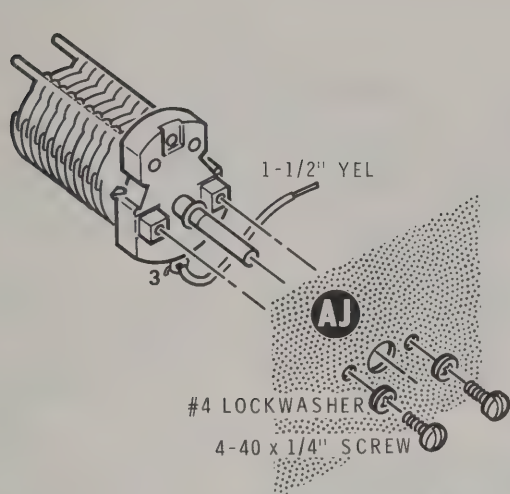
- (✓) Insert the connector pin into chassis connector BC hole 6. Push in on the pin until it locks in place in the connector.

- (✓) Connect the other end of the wire to control AF lug 7 (S-1).

- (✓) Connect a 6" yellow wire from circuit board hole E to control AF lug 8 (S-2).

- (✓) Refer to Detail 4-4B and connect a 1-1/2" yellow wire to lug 3 (S-1) of the loading capacitor (#26-154) as shown.





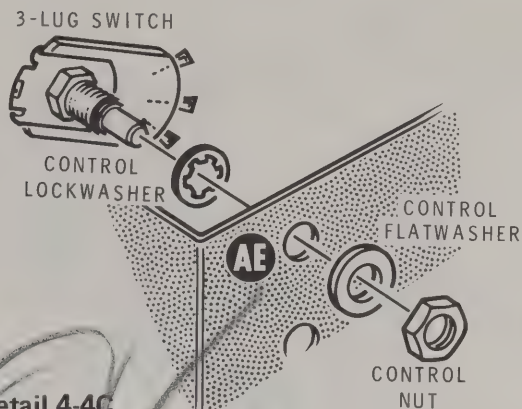
Detail 4-4B

- (✓) C303: Refer to Detail 4-4B and install the prepared loading capacitor at AJ with 4-40 x 1/4" hardware. Position the capacitor as shown in the Pictorial. Also, be sure no wires or cables are caught under the capacitor.

- (✓) Connect the free end of the 1-1/2" yellow wire coming from lug 3 of this capacitor to switch SW2 pin 11 (S-1). NOTE: Be sure you position this wire so that, when the movable plates of the capacitor are turned, they will not hit the wire.

- (✓) Locate the shielded cable coming from cable-tie E. Then cut the shield lead off the free end of the cable.

- (✓) Connect the inner lead of this cable to capacitor AJ lug 2 (S-1).



Detail 4-4C

- (✓) SW302: Refer to Detail 4-4C and install a 3-lug rotary switch (#63-3) at AE. Position the switch so the space between lugs 1 and 2 is toward the screw at AD, as shown in the Pictorial.

Connect the 3-wire cable coming from cable-tie F (cable marked Y on the Pictorial) to switch AE as follows:

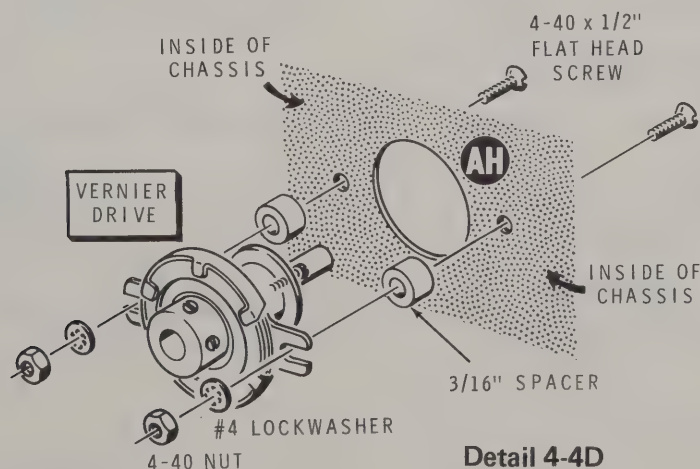
- (✓) Red to lug 3 (S-1).

- (✓) White to lug 2 (S-1).

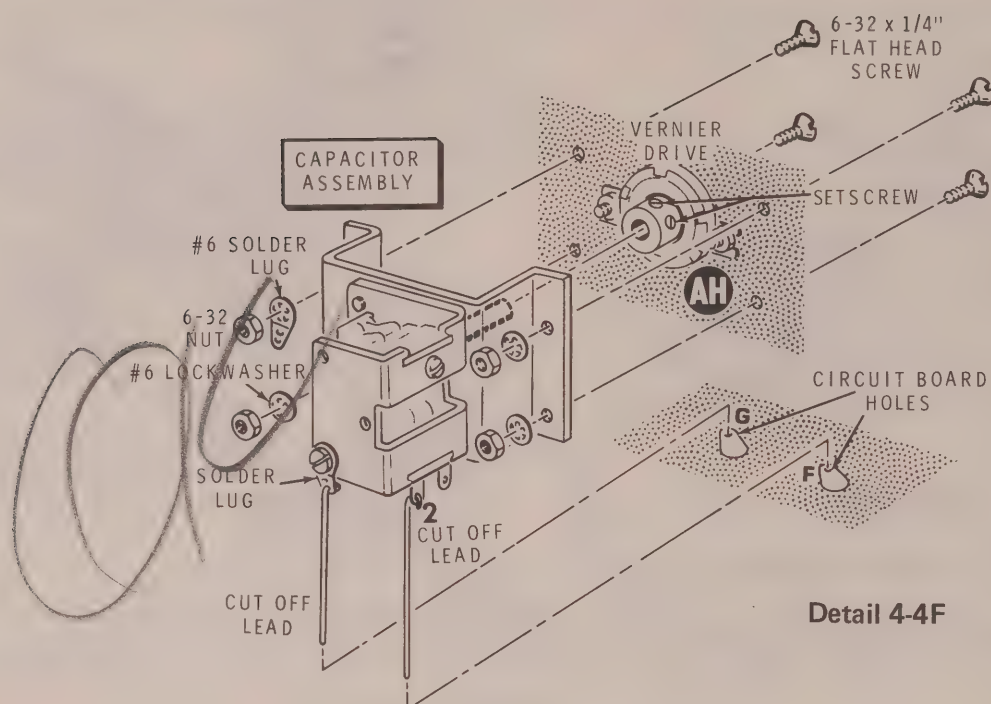
- (✓) Black to lug 1 (S-1).

- (✓) Carefully press the wires down out of the way under the body of the switch.

- (✓) Refer to Detail 4-4D and mount the vernier drive (#100-1608) at AH with 4-40 x 1/2" hardware and 3/16" spacers. Be sure to center the vernier drive in the opening.



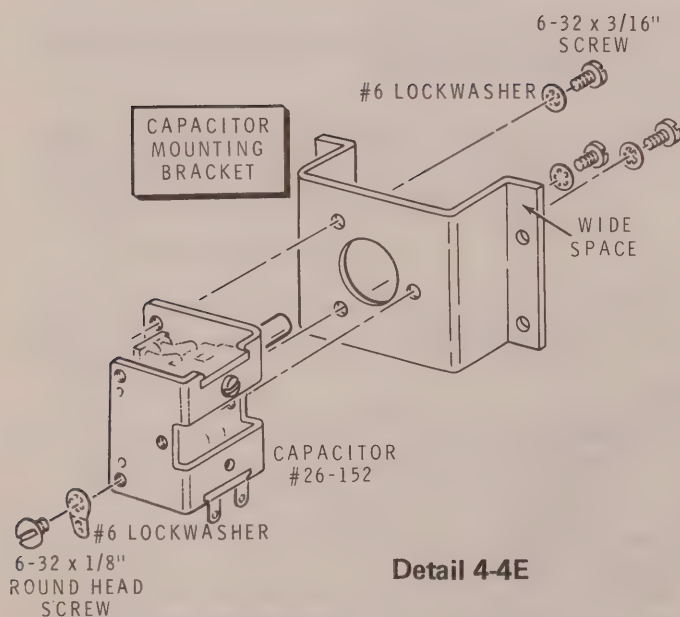
Detail 4-4D



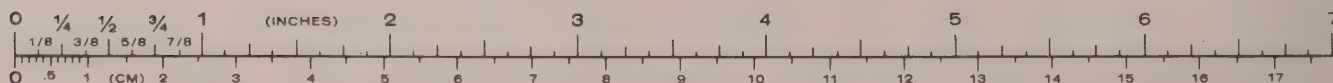
Detail 4-4F

**CAUTION:** Keep the rotor (movable plates) of the capacitor closed while you perform the following steps.

- (✓) C302A/B: Refer to Detail 4-4E and mount the VFO tuning capacitor (#26-152) on the capacitor mounting bracket with 6-32 x 3/16" hardware. **CAUTION:** Be sure you position the bracket so its wide space is located as shown.
- (✓) Mount a #6 solder lug on the capacitor frame with a 6-32 x 1/8" round head screw. Position the solder lug as shown in the Detail.
- (✓) Remove the insulation from two 1-1/2" yellow wires.
- (✓) Refer to Detail 4-4F and connect a 1-1/2" bare wire to the solder lug on the capacitor assembly as shown (S-1).
- (✓) In a similar manner, connect a 1-1/2" bare wire to lug 2 on the capacitor (S-1).

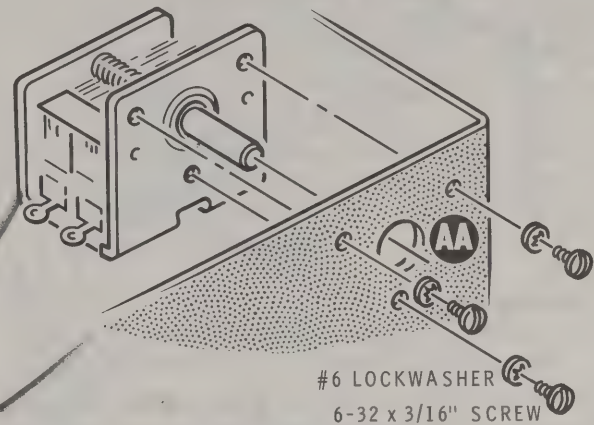


Detail 4-4E



## NOTES:

1. You will guide the bare wires on the capacitor assembly into holes in the circuit board when you mount the assembly in the following steps. At the same time, you will insert the shaft of the capacitor into the hole in the vernier drive.
2. Loosen the setscrews in the vernier drive just enough to allow the capacitor shaft to enter the hole in the drive. CAUTION: Be sure you do not lose the setscrews.
- (✓) Guide the two bare wires on the capacitor assembly into circuit board holes G and F, at the same time, insert the capacitor shaft into the hole in the vernier drive. See Pictorial 4-4 and Detail 4-4F.

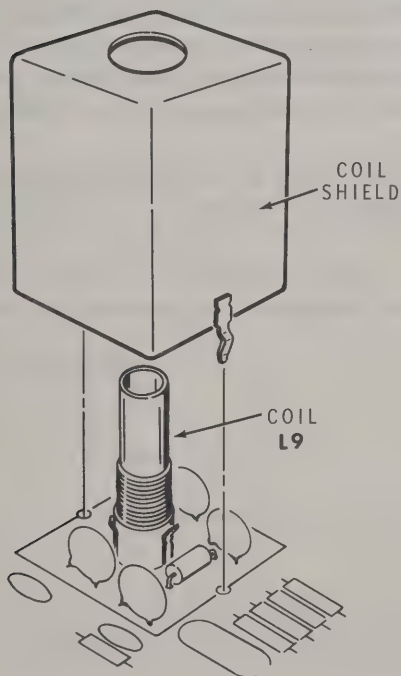


Detail 4-4H

- (✓) Refer to Detail 4-4F and mount the capacitor assembly at AH with 6-32 x 1/4" flat head hardware. NOTE: Use a #6 solder lug at AG instead of a lockwasher. Also, be sure none of the cables are pinched under the assembly.

- (✓) Connect the free end of the bare wire coming from control AF lug 1 to solder lug AG (S-1).

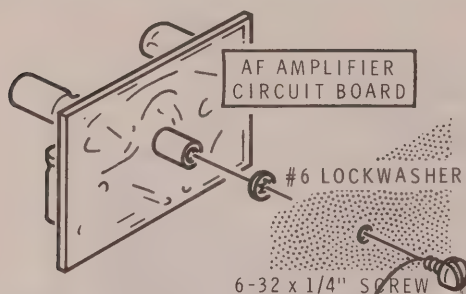
- (✓) Locate the coil shield (#206-502). Then refer to Detail 4-4G and install the shield over coil L9 on the circuit board.



Detail 4-4G

NOTE: Before you solder the wires in the next step, be sure you pull them as far as possible through the circuit board holes.

- (✓) Turn the Transceiver over and solder the shield lugs and the two bare wires protruding from the circuit board to the foil. Then cut off ONLY the excess wire lengths.
- (✓) C301A/B: Refer to Detail 4-4H and install a 2-section variable capacitor (#26-151) at AA with 6-32 x 3/16" hardware.
- (✓) Connect a 2-1/2" yellow wire from coil L1 lug 4 (S-1) to capacitor AA lug 1 (S-1).
- (✓) Connect a 3" yellow wire from circuit board hole A (S-1) to capacitor AA lug 2 (S-1).



Detail 4-4J

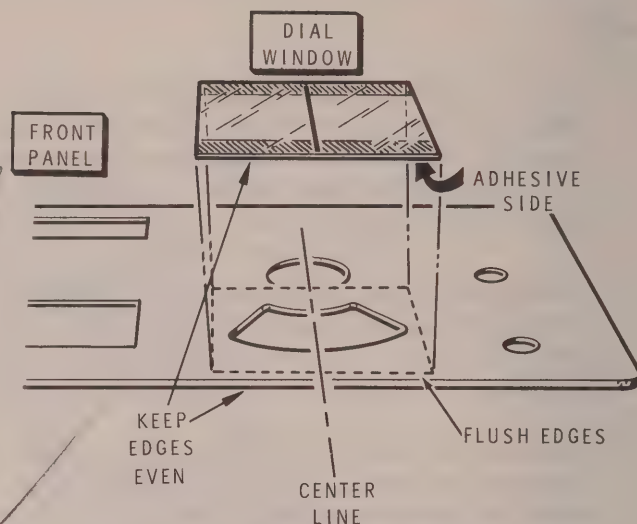
NOTE: In the next step, you will connect the free end of "the green wire," at the lower left corner of the chassis, to the circuit board of the previously set-aside AF amplifier assembly.

- (✓) Connect the free end of the green wire (coming from 3-wire cable X) to the hole marked IN on the AF amplifier circuit board (S-1).
- ( ) Refer to Detail 4-4J and mount the AF amplifier assembly at CB with 6-32 x 1/4" hardware. Position the assembly as shown in the Pictorial.

Refer to Pictorial 4-4 for the following steps.

Connect the free end of the wires coming from the AF amplifier assembly as follows:

- (✓) Wire from hole +12 to main circuit board hole VA (S-1).
- (✓) Wire from hole GND to jack BD lug 1 (S-2).
- (✓) Wire from hole OUT to jack BD lug 2 (S-2).



Detail 4-5A

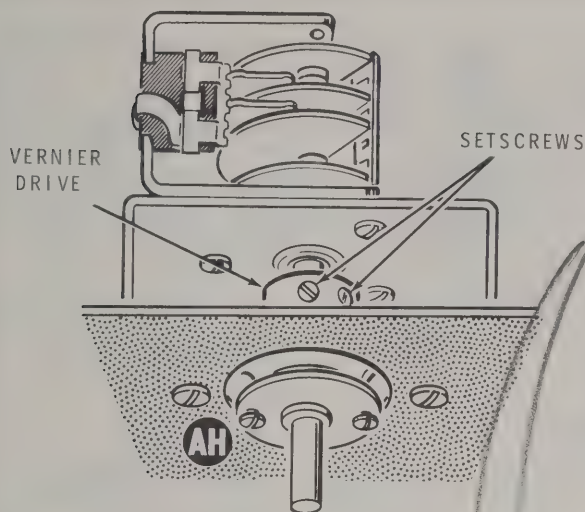
## FRONT PANEL MOUNTING

- (✓) Refer to Detail 4-5A and mark the inside of the front panel as shown by the center line through hole AH.

- (✓) Remove the lengths of tape from the dial window (#446-602-1). Position the black line on the window over the line marked on the panel. Position the edge of the window even with the edge of the panel as shown. Then press the window firmly onto the panel. NOTE: Be careful you do not scratch the window.

Refer to Pictorial 4-5 in the Illustration Booklet for the following steps.

- ( ) Refer to Detail 4-5B and turn the shaft of vernier drive AH until its setscrews are positioned as shown.



Detail 4-5B

- (✓) Temporarily remove the two brass screws from the front of the vernier drive.
- (✓) Place the dial on the vernier drive so the scale of the dial is toward the right as shown in the Pictorial. Then secure the dial to the vernier drive with the previously removed brass screws. CAUTION: Do not scratch the face of the dial.
- (✓) Place the front panel on the chassis. Then secure it with control nuts at AE and AF. Be careful you do not scratch the panel when you tighten the control nuts.

## INSTALLING KNOBS

- (✓) Start 6-32 x 1/8" setscrews in the four small knobs.
- (✓) Start an 8-32 x 3/8" setscrew into the large knob.
- (✓) Turn the outer and inner shafts of control AF counterclockwise as far as they will go. NOTE: Be sure you turn the inner shaft until the switch clicks off.
- (✓) With the tab of the silver knob in the MIN position, press the knob onto the slotted outer shaft of control AF.

- (✓) Place the split bushing on the inner shaft of control AF; then press a small knob on the bushing. Turn the knob until its color dot is lined up with the word OFF on the panel and securely tighten the knob setscrew.
- (✓) Turn the shaft of capacitor AA fully counterclockwise and place a small knob on its shaft. Line up the color dot on the knob with the left scale-mark on the panel; then tighten the setscrew.
- (✓) Turn the shaft of switch AE fully clockwise and place a small knob on its shaft. Line up the color dot with the NARROW line on the panel and tighten the setscrew.
- (✓) Turn the shaft of capacitor AJ until the capacitor plates are fully meshed; then place a small knob on the shaft. Line up the color dot on the knob with the left scale-mark on the panel and tighten the setscrew.
- (✓) Place the large knob on the shaft of vernier drive AH and tighten the setscrew. NOTE: Be sure the knob turns freely and does not rub against the panel.

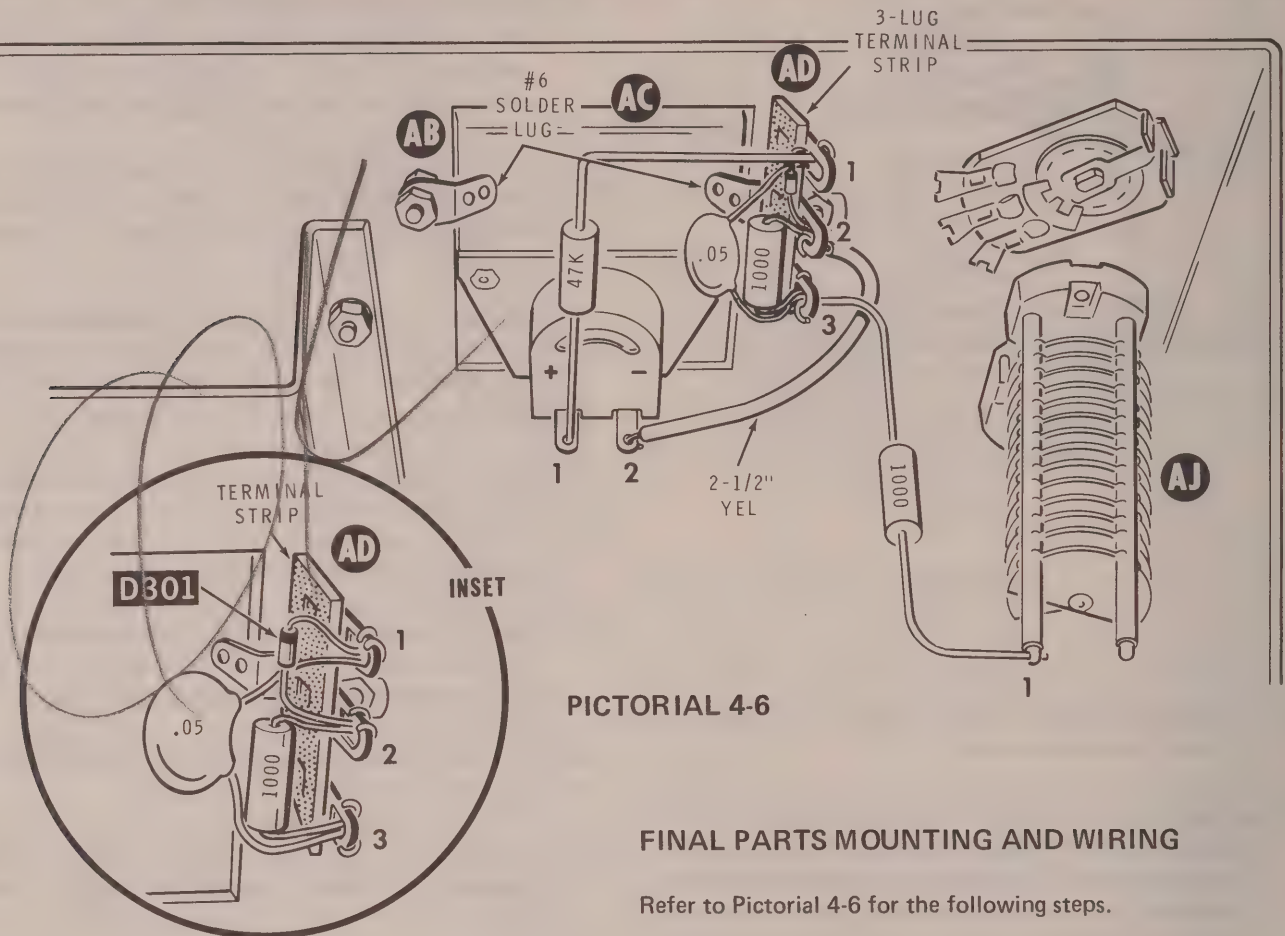
NOTE: When you perform the next step, be very careful you do not bend the plates of the capacitor.

- (✓) Carefully turn the rotor (movable plates) of the capacitor at AH fully clockwise (unmeshed).
- (✓) Turn the large knob CLOCKWISE until the mark to the left of the zero on the dial scale is lined up with the black line of the window.
- (✓) Refer to Detail 4-5B and securely tighten the two setscrews in the vernier drive.

NOTE: Do not forcefully rotate the tuning capacitor to its extreme end stops. This could damage the tuning capacitor plates.

- (✓) Rotate the large knob and turn capacitor AH to its full open or closed position; then continue to turn the large knob. The left or right end of the dial scale should stay lined up with the reference line of the window. NOTE: If the dial does not stay lined up, the capacitor shaft is slipping in the vernier drive. If this occurs, perform the previous two steps over again and make sure the set screws in the vernier drive are tight.

NOTE: Do not forcefully rotate the tuning capacitor to its extreme end stops. This could damage the tuning capacitor plates.

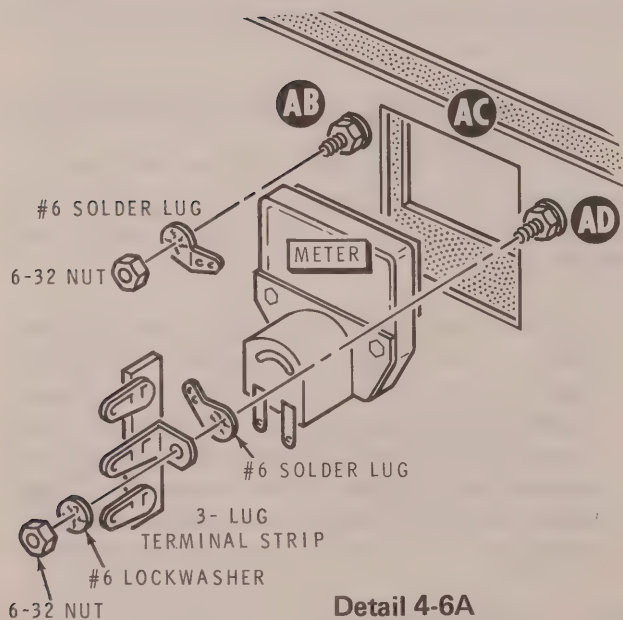


PICTORIAL 4-6

## FINAL PARTS MOUNTING AND WIRING

Refer to Pictorial 4-6 for the following steps.

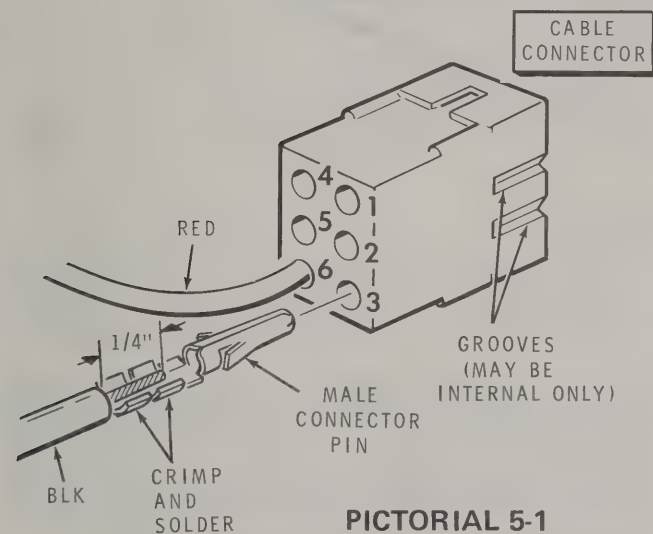
- (✓) Refer to Detail 4-6A and install the signal meter at AC. Use a #6 solder lug and 6-32 nut at AB. Use a #6 solder lug, 3-lug terminal strip, #6 lockwasher, and 6-32 nut at AD. NOTE: Be sure you position the terminal strip and solder lugs as shown in the Pictorial.
- (✓) R302: Connect a 1000  $\Omega$  (brown-black-red) resistor from capacitor AJ lug 1 (S-1) to terminal strip AD lug 3 (NS).
- (✓) Remove the shorting wire or clip between lugs 1 and 2 of meter AC.
- (✓) R305: Connect a 47 k $\Omega$  (yellow-violet-orange) resistor between meter AC lug 1 (S-1) and terminal strip AD lug 1 (NS).
- (✓) Connect a 2-1/2" yellow wire from meter AC lug 2 (S-1) to terminal strip AD lug 2 (NS).



Detail 4-6A

NOTE: Refer to the inset drawing on Pictorial 4-6 for the following steps.

- (✓) R303: Connect a 1000  $\Omega$  (brown-black-red) resistor between terminal strip AD lugs 3 (NS) and 2 (NS).
- (✓) D301: Connect the lead at the banded end of a 1N458 diode (#56-24) to terminal strip AD lug 1 (NS). Connect the other diode lead to lug 2 (S-3).
- (✓) C304: Connect a .05  $\mu$ F disc capacitor between terminal strip AD lugs 3 (S-3) and 1 (S-3).

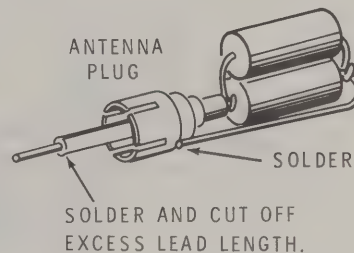
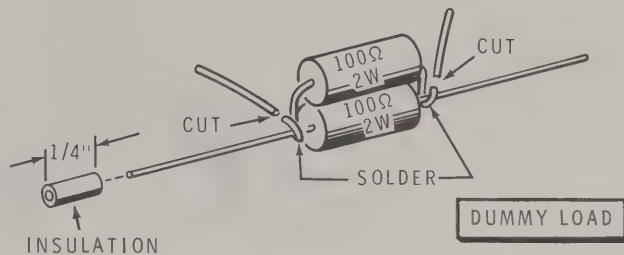


PICTORIAL 5-1

## PREPARING POWER CABLE

Refer to Pictorial 5-1 for the following steps.

- (✓) Remove 1/4" of insulation from each end of the red and the black wires supplied with the kit. Then twist the strands and apply a small amount of solder to the wire ends to hold the strands together. NOTE: Save one of the 1/4" lengths of insulation for use later.
- (✓) Install a male connector pin on one end of the red and one end of the black wires.
- (✓) Insert the connector pin on the black wire into hole 3 of the cable connector. Press the pin in until it locks in place in the cable connector.
- (✓) In the same manner, insert the connector pin on the red wire into hole 6 of the cable connector.



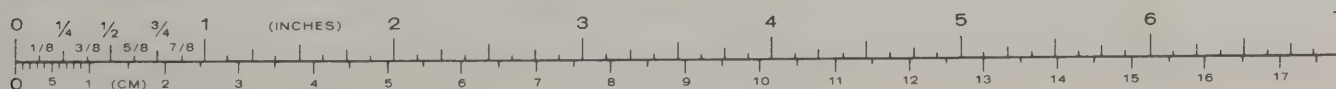
PICTORIAL 5-2

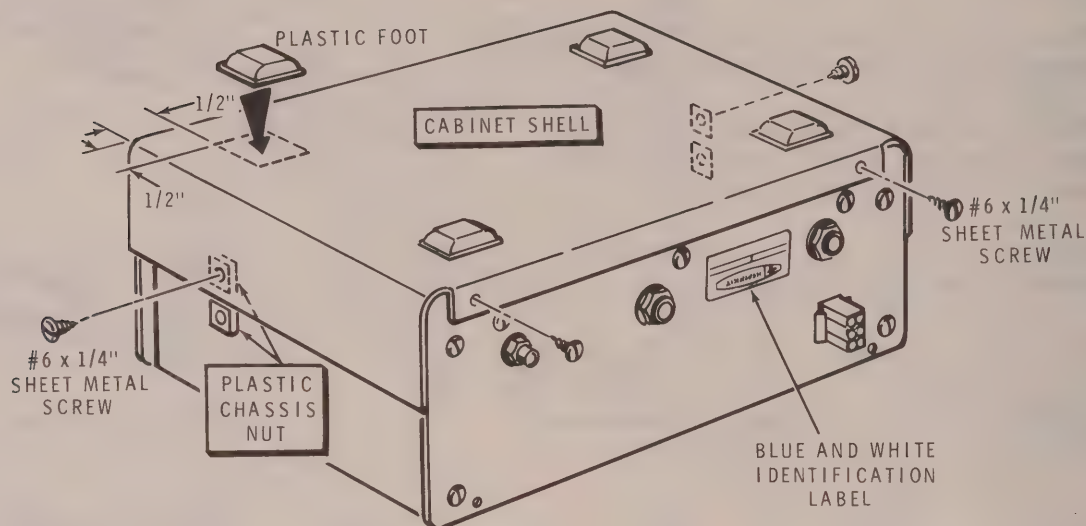
## PREPARING DUMMY LOAD

Refer to Pictorial 5-2 for the following steps.

- (✓) Locate the two 100  $\Omega$ , 2-watt (brown-black-brown) resistors. Bend the leads of one resistor around the leads of the other resistor as shown. Then solder both connections and cut off the indicated resistor leads.
- ( ) Place the previously saved 1/4" length of insulation on one lead of the resistor assembly.
- ( ) Insert this lead of the assembly into the antenna plug as shown. Then solder the lead to the pin. NOTE: Apply heat to the tip of the pin only long enough to allow the solder to flow into the pin. Allow the connection to cool; then cut off the excess lead length.
- ( ) Bend the other lead as shown. Then solder the lead to the shell of the antenna plug.

This completes the wiring of your Transceiver. Carefully inspect all connections for loose wires or unsoldered connections. Remove any wire clippings or solder splashes.





PICTORIAL 5-3

Refer to Pictorial 5-3 for the following steps.

- (✓) Place a cabinet shell on the bottom of the Transceiver. Secure the shell with four #6 x 1/4" sheet metal screws at the rear and sides of the Transceiver.
- (✓) Remove the protective backing from a plastic foot. Then press the foot onto the corner of the bottom cabinet shell as shown.
- (✓) In a similar manner, install a plastic foot at each remaining corner.

NOTE: The blue and white identification label you will install in the next step shows the model number and production series number of your kit. Refer to these numbers in any communications you may have with the Heath Company regarding your kit. This will assure you of receiving the most up-to-date information in return.

- (✓) Carefully remove the backing paper from the blue and white label. Then press the label on the rear panel at the indicated location. Place the backing paper over the label and then firmly press the label on the panel.

Proceed to the "Initial Tests."

# INITIAL TESTS

The following tests are performed on your Transceiver to make sure it is operating properly before you begin alignment. If you do not obtain the indicated results at any time, turn the Transceiver off and refer to the "In Case of Difficulty" section on Page 69.

You will need a pair of high impedance (about 2000  $\Omega$ ) headphones, a key, and a 13.4-volt DC power supply to complete the Initial Tests and Alignment.

Refer to Figure 1-2 in the Illustration Booklet for the following steps.

(✓) Set all of the front panel controls fully counterclockwise.

(✓) Set the SIDETONE LEVEL control to the center of its rotation.

(✓) Push the 7.0 MHz band switch in.

(✓) Connect the 50  $\Omega$  dummy load to the ANTENNA socket on the rear panel.

(✓) Connect a pair of headphones to the HEADPHONE jack on the rear panel.

(✓) Connect the key to the KEY jack on the rear panel.

( ) Plug the power cable onto the POWER socket on the rear panel.

(✓) Connect the power cable red lead to the + (positive) terminal and the black lead to the - (negative) terminal of a 13.4 VDC power source. CAUTION: Be sure you observe the correct polarity; otherwise the transistors in the Transceiver will be damaged.

(✓) Turn the Transceiver power on by rotating the AF GAIN control clockwise until it "clicks" on.

(✓) Turn the AF GAIN control to the center of its rotation. Noise should be heard in the headphones.

(✓) Key the Transceiver. The relay should click and a sidetone should be heard in the headphones. Adjust the SIDETONE VOLUME control on the circuit board for a comfortable listening level. Release the key.

(✓) Turn the AF GAIN control counterclockwise until it "clicks" off.

This completes the Initial Tests. Proceed to the "Alignment" section. Do not disconnect the power supply, key, or headphones from the Transceiver.

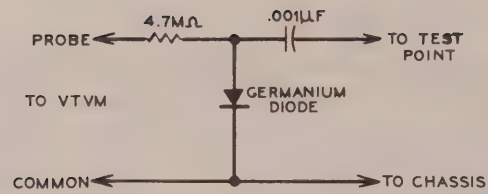


Figure 1-3

# ALIGNMENT

The following alignment procedure requires the use of a calibrated Receiver capable of receiving 7.0 to 7.25 MHz, an RF Signal Generator, and a VTVM with an RF Probe. If a Signal Generator is not available, use an on-the-air signal. Figure 1-3 is a schematic of a simple RF Probe which you can make if one is not available. CAUTION: A cabinet shell must be installed on the bottom of the Transceiver before you start the following procedure.

Refer to Figure 1-2 in the Illustration Booklet for the following procedures.

## HFO (Heterodyne Frequency Oscillator)

- ( ) Connect the RF probe of the VTVM to test point TP1. This is the lead at the indicated end of resistor R94, a 68 k $\Omega$  (blue-gray-orange) resistor.
- ( ) Turn the Transceiver on and press the 3.5 MHz pushbutton.

NOTE: You can reach the bottom slug in coils L17/L18 and L19/L21 by inserting the longer end of the alignment tool through the top slug; then on down to the bottom slug. Be careful when you do this so that you do not damage or turn the top slug.

- ( ) Use the smaller alignment tool and adjust the bottom slug in coil L17/L18 to obtain a peak reading on the VTVM. Then turn the slug an additional 1/4 turn clockwise. The VTVM should read approximately 0.6 volts.
- ( ) Press the 7.0 MHz pushbutton.
- ( ) Adjust the top slug in coil L17/L18 to obtain a peak reading on the VTVM. Then turn the slug an additional 1/4 turn counterclockwise. The meter should read approximately 0.6 volts.
- ( ) Press the 14.0 MHz pushbutton.
- ( ) Adjust the bottom slug in coil L19/L21 to obtain a peak reading on the VTVM. Then turn the slug an additional 1/4 turn clockwise. The VTVM should read approximately 0.6 volts.
- ( ) Press the 21.0 MHz pushbutton.
- ( ) Adjust the top slug in coil L19/L21 to obtain a peak reading on the VTVM. The VTVM should read approximately 0.6 volts. Then turn the slug 1/4 turn counterclockwise.
- ( ) Disconnect the VTVM from the Transceiver.

## VFO (Variable Frequency Oscillator)

- (✓) Turn the calibrated receiver on and allow it to warm up. Tune the receiver to approximately 7.0 MHz.
- (✓) Press the 7.0 MHz pushbutton on the Transceiver.
- (✓) Connect one end of a suitable length of wire to the antenna terminal on the calibrated receiver. Loop the other end of this wire around coil L19/L21 as shown in inset drawing #2 on Figure 1-2.
- (✓) Turn the Transceiver on and allow it to warm up for at least 30 minutes before you proceed with the following adjustments.

NOTE: In the following steps, you will zero beat the calibrated receiver; first against its own crystal calibrator, and then against the Transceiver. A zero beat is a point where the two frequencies being combined (or beat against each other) are exactly the same. As you approach zero beat, the tone caused by the two combined frequencies will gradually decrease in pitch and volume until it stops. This point is very sharp so you must tune very carefully.

- (✓) Set the calibrated receiver's Function switch to the SSB or CW position.
- (✓) Tune the calibrated receiver to 7.0 MHz. Then turn on its crystal calibrator and zero beat the receiver frequency against the crystal calibrator frequency. *HW101*
- (✓) Turn off the crystal calibrator. NOTE: Be careful that you do not change the setting of the receiver frequency.
- (✓) Refer to inset drawing #1 of Figure 1-2 and insert the metal blade (#205-778) into the small end of the plastic nut starter.

NOTE: Use the alignment tool that you made from the nut starter and blade for all trimmer adjustments. DO NOT use a screwdriver.

- (✓) Turn the Transceiver tuning dial to 0. *HW8*
- (✓) Adjust trimmer capacitor C302B until you hear a zero beat from the calibrated receiver. *HW101*

- (✓) Turn the Transceiver dial to 250. *HW8*
- (✓) Turn the calibrated receiver dial to 7.250 MHz. *HW101*
- (✓) Use the larger alignment tool to turn the slug in coil L9 until you hear a zero beat from the calibrated receiver. It may be necessary to turn down the calibrated receiver's AF gain control. *HW101*
- (✓) Repeat the VFO alignment steps several times until the calibrated receiver's dial coincides with the 0 and 250 marks on the Transceiver's dial.
- (✓) Turn off the calibrated receiver and remove the wire from around coil L19/L21 in the Transceiver. The calibrated receiver will no longer be used.

## MIXER AMPLIFIER

- (✓) Turn the Transceiver tuning dial to 100.
- (✓) Connect the RF Probe of the VTVM to test point TP2. This is the lead at the indicated end of R49, a 270  $\Omega$  (red-violet-brown) resistor.
- (✓) Press the 3.5 MHz pushbutton and adjust coil L13 for a peak reading on the VTVM.
- (✓) Press the 7.0 MHz pushbutton and adjust coil L14 for a peak reading on the VTVM.
- (✓) Press the 14.0 MHz pushbutton and adjust coil L15 for a peak reading on the VTVM.
- (✓) Turn the Transceiver tuning dial to 150.

NOTE: When you perform the next step, you may have to turn the coil slug several turns counterclockwise before you obtain a peak reading on the VTVM.

- (✓) Press the 21.0 MHz pushbutton and adjust coil L16 for a peak reading on the VTVM.
- ( ) Disconnect the RF Probe from Test point TP2.

## TRANSMITTER

(✓) Plug the previously prepared 50  $\Omega$  dummy load into the ANTENNA socket on the back of the Transceiver. (This may already be connected to the Transceiver.)

(✓) Connect the key to the KEY jack on the back of the Transceiver. (This also may already be connected to the Transceiver.)

NOTE: Use the alignment tool that you made from the nut starter and blade for all trimmer adjustments. DO NOT use a screwdriver.

(✓) Turn the screws in trimmers C95, C99, C103, and C106 clockwise until they stop turning. Do not force the screws.

(✓) Turn the screw in trimmer C95 1/2 turn counterclockwise.

(✓) Turn the screw in trimmer C99 1/8 turn counterclockwise.

(✓) Turn the screw in trimmer C103 1 turn counterclockwise.

(✓) Turn the screw in trimmer C106 1/4 turn counterclockwise.

(✓) Make sure the TUNING dial is set to 100.

(✓) Press the 3.5 MHz pushbutton.

(✓) Set the LOADING control on the front panel to the 12 o'clock position.

NOTE: In the following steps, the adjustments will be quite broad.

(✓) Key the Transceiver and adjust trimmer C95 for a maximum reading on the RELATIVE POWER meter.

(✓) Key the Transceiver and adjust the LOADING control on the front panel to obtain a maximum reading on the RELATIVE POWER meter.

(✓) Repeat the previous two steps.

(✓) Press the 7.0 MHz pushbutton.

(✓) Set the LOADING control to the 12 o'clock position.

(✓) Key the Transceiver and adjust trimmer C99 to obtain a maximum reading on the RELATIVE POWER meter.

(✓) Key the Transceiver and adjust the LOADING control on the front panel to obtain a maximum reading on the RELATIVE POWER meter.

(✓) Repeat the previous two steps.

(✓) Press the 14.0 MHz pushbutton.

(✓) Set the LOADING control to the 12 o'clock position.

(✓) Key the Transceiver and adjust trimmer C103 to obtain a maximum reading on the RELATIVE POWER meter.

(✓) Key the Transceiver and adjust the LOADING control on the front panel to obtain a maximum reading on the RELATIVE POWER meter.

(✓) Repeat the previous two steps.

(✓) Press the 21.0 MHz pushbutton.

(✓) Set the LOADING control to the 12:00 o'clock position.

(✓) Key the Transceiver and adjust trimmer C106 to obtain a maximum reading on the RELATIVE POWER meter.

(✓) Key the Transceiver and adjust the LOADING control to obtain a maximum reading on the RELATIVE POWER meter.

(✓) Repeat the previous two steps.

(✓) Turn the Transceiver off.

(✓) Disconnect the key and dummy load from the Transceiver.

## RECEIVER

- (☒) Connect a pair of headphones to the HEADPHONES jack on the back of the Transceiver.

NOTE: You may use a nearby accurately calibrated transmitter for the following adjustments. If you do use one, connect a small piece of wire to the Transceiver's antenna socket. The small wire will act as a simple antenna. (You may also use an appropriate antenna.)

- (☒) Connect a signal generator to the ANTENNA socket on the back of the Transceiver.
- (☒) Turn the signal generator on and allow it to warm up.
- (☒) Set the Transceiver tuning dial to 250.
- (☒) Set the RECEIVER PRESELECTOR to 14.
- (☒) Set the RF GAIN control to MAX.
- (☒) Turn the Transceiver on and adjust the AF GAIN control for a comfortable listening level.

NOTE: In the following steps, as you approach the point of resonance of a trimmer capacitor or coil, the sound from the headphones will increase. As this occurs, decrease the output of the signal generator to the lowest level that you can still hear. This will prevent overloading the receiver.

- (☒) Press the 3.5 MHz pushbutton.
- (☒) Adjust the signal generator frequency to approximately 3.750 MHz or until you hear the signal in the headphones. The output of the generator may have to be quite high.
- (☒) Alternately adjust trimmers C3 and C16 for maximum sound in the headphones.
- (☐) Press the 7.0 MHz pushbutton.

- (☒) Adjust the signal generator frequency to approximately 7.25 MHz or until you hear it in the headphones. The output of the generator may have to be quite high.

- (☒) Alternately adjust trimmers C6 and C19 for maximum sound in the headphones.

- (☒) Set the Transceiver tuning dial to 100.

- (☒) Adjust the signal generator frequency to approximately 7.100 MHz or until you hear it in the headphones.

- (☒) Adjust the RECEIVER PRESELECTOR for maximum sound in the headphones.

- (☒) Readjust trimmer C6 for maximum sound in the headphones. NOTE: Do not adjust trimmer C19.

- (☒) Press the 14.0 MHz pushbutton.

- (☒) Set the Transceiver tuning dial to 250.

- (☒) Set the RECEIVER PRESELECTOR to 14.

- (☒) Adjust the signal generator frequency to approximately 14.25 MHz or until you hear it in the headphones.

- (☒) Alternately adjust trimmers C7 and C22 for maximum sound in the headphones.

- (☒) Press the 21.0 MHz pushbutton.

- (☒) Adjust the signal generator frequency to approximately 21.25 MHz or until you hear it in the headphones.

- (☒) Alternately adjust trimmers C9 and C24 for maximum sound in the headphones.

- (☒) Turn the Transceiver off.

- (☒) Disconnect the signal generator from the Transceiver.

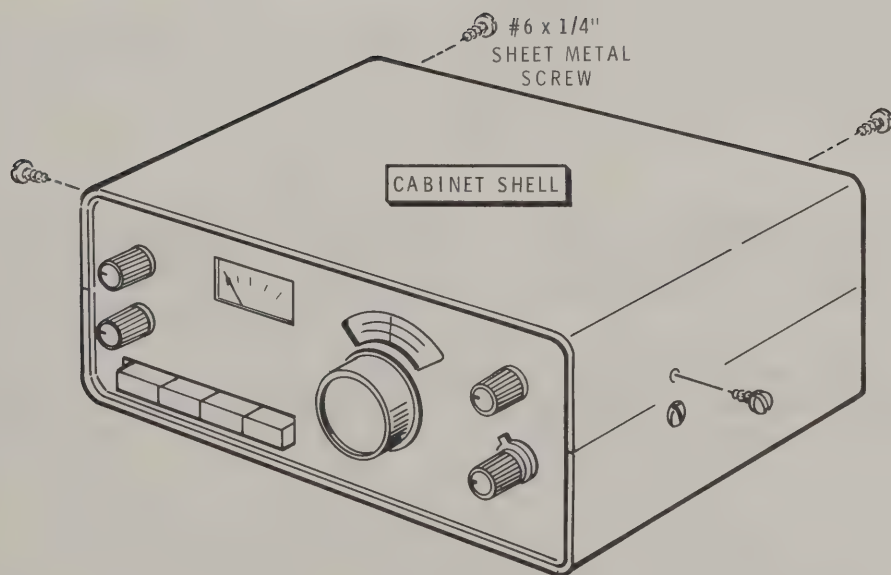
This completes the "Transceiver Alignment." Proceed to "Final Assembly."

# FINAL ASSEMBLY

Refer to Pictorial 5-4 for the following steps.

- ( ) Place the remaining cabinet shell on the Transceiver as shown.
- ( ) Secure the cabinet shell to the Transceiver with #6 x 1/4" sheet metal screws at the rear and sides as shown.

This completes the assembly of your Transceiver. Proceed to "Operation."



PICTORIAL 5-4



# OPERATION

Refer to Figure 1-2 for the following steps.

- ( ) Plug the power cable onto the POWER socket on the rear panel.
- ( ) Connect the power cable red lead to the + (positive) terminal and the black lead to the — (negative) terminal of a 13.4 VDC power source. CAUTION: Be sure you observe the correct polarity; otherwise the transistors in the Transceiver will be damaged.
- ( ) Connect a key to the KEY jack on the rear panel.
- ( ) Connect an antenna to the ANTENNA socket on the rear panel. (See the following information on antennas.)
- ( ) Connect a pair of headphones to the HEADPHONES jack on the rear panel.

## ANTENNAS

The Transceiver should be used with 50 ohm to 75 ohm antennas having a low VSWR. Lightweight hookup wire dipoles and inverted vee's are sufficient for solid contacts. They can be quickly strung up for camping trips and emergency operation, as well as field day use. However, antennas of the beam and quad type will provide a significant improvement in performance, much more so than for medium to high-power rigs.

The "ARRL Antenna Book" is commonly available and includes comprehensive reference work on transmission lines and antennas. Other similar handbooks for the amateur are offered for sale and can often be found in a public library.

- ( ) Push in the Band switch for the band you intend to operate on.
- ( ) Turn the Transceiver on by rotating the AF GAIN control clockwise until it "clicks" on. Then continue to rotate the control clockwise to a comfortable listening level.
- ( ) Adjust the Main Tuning to the portion of the band where you intend to operate.

NOTE: When tuning across the band, always go to the high end of the band first and tune down to the low end. This is to assure that you will be on the high side of the zero beat when listening to a signal. Otherwise you may answer a CQ on the low side of zero beat and your transmitting frequency will be too low.

- ( ) Listen to the headphones and adjust the RECEIVER PRESELECTOR for maximum signal loudness (fully clockwise for 15 and 20 meter operation).
- ( ) Key the Transceiver and rotate the LOADING control to obtain a maximum meter indication. The Transceiver is now ready for on-the-air operation.

## OPERATING HINTS

When operating a QRP (low power) rig, your transmitted signal may be below the signal level preferred by most operators. Generally, lower power signals lose out unless a few simple techniques are followed. In many cases, listening for a CQ is more acceptable since your signal has a greater chance of being copied this way. Or you can try to contact a station just after he completes a contact. Also, be sure that you are on the high side of zero beat when you transmit as described previously.

Emergency operation is sometimes a necessity and always unexpected. The Transceiver is well suited for these situations if an antenna is available. A power source is usually no problem since any automobile battery or lantern

batteries of the appropriate voltage can provide hours of dependable operation. Refer to the "Specifications" section for voltage and current requirements.

You can vary the hold-in time of the antenna relay by adjusting BREAK-IN DELAY control R68 on the main circuit board. Adjust this control to obtain the desired delay after you have released the key.

Look for QRP operators on the following frequencies:

3.354 MHz	21.040 MHz
7.040 MHz	28.040 MHz
14.065 MHz	

# IN CASE OF DIFFICULTY

This part of the Manual will help you locate and correct any difficulties which might occur. This information is divided into:

Visual Checks.

Precautions for Bench Testing.

Troubleshooting Chart.

NOTE: If you prefer to have your Transceiver repaired at the factory or at one of the Heathkit Electronic Centers, or if you need additional information before you proceed, refer to the "Customer Service" information inside the rear cover of this Manual. Your Warranty is located inside the front cover.

## VISUAL CHECKS

1. About 90% of the kits that are returned for repair do not function properly due to poor soldering. Therefore, you can eliminate many troubles by a careful inspection of connections to make sure they are soldered as described on Page 6 of this Manual and in the Soldering section of the "Kit Builders Guide." Reheat any doubtful connections and be sure all the wires are soldered at places where several wires are connected. Check carefully for solder bridges between circuit board foils.
2. Check to be sure that all transistors and diodes are in their proper locations, and are installed correctly.
3. Check the value of each part. Be sure that the proper part has been wired into the circuit, as shown in the Pictorial diagrams and as specified in the wiring instructions. It would be easy, for example, to install a 220  $\Omega$  (red-red-brown) resistor in a step that calls for a 22 k $\Omega$  (red-red-orange) resistor.
4. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as you check it. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you have consistently overlooked.
5. Check all of the wires that are connected to the circuit board to be sure they do not touch the chassis or other lugs. Make sure all wires are properly soldered.
6. A review of the "Circuit Description" may help you to determine the problem.
7. If the difficulty still is not cured, read the "Precautions for Bench Testing" section, and the section titled "Troubleshooting Charts."

## PRECAUTIONS FOR BENCH TESTING

NOTE: Use a high input impedance voltmeter for voltage measurements.

1. Be cautious when testing transistor circuits. Although transistors have almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than other circuit components.
2. Be sure you do not short circuit any terminals when you make voltage measurements. If the probe should slip, for example, and short out a bias or voltage supply point, it is almost certain to damage one or more transistors or diodes.
3. Do not remove any components while the kit is operating; this could cause considerable damage.

If you make repairs to your Transceiver, make sure you eliminate the cause as well as the effect of the trouble. If, for example, you should find a damaged resistor, be sure to find out what caused the resistor to become damaged. If the cause is not eliminated, the replacement resistor may also become damaged when the Transceiver is put back into operation.

## Troubleshooting Chart

The following chart lists conditions and possible causes of several specific malfunctions. If a particular part is mentioned (Q7 for example) as a possible cause, check that part to see that it is installed and/or wired correctly. It is also possible, on rare occasions, for a part to be faulty and require replacement.

CONDITION	POSSIBLE CAUSE
No signals can be received on any band. However, headphone noise is heard when the AF Gain control is advanced.	1. Transistor Q1 or IC1 is incorrectly installed or shorted.
No signals are received on the 3.5 MHz band.	1. Diode D1 or D5 incorrectly installed or shorted.
No signals are received on the 7.0 MHz band.	1. Diode D2 or D6 incorrectly installed or shorted.
No signals are received on the 14.0 MHz band.	1. Diode D3 or D7 incorrectly installed or shorted.
No signals are received on the 21.0 MHz band.	1. Diode D4 or D8 incorrectly installed or shorted.
No sound of any kind from the headphones.	1. Transistor Q201 or IC2 incorrectly installed or shorted. 2. Phone jack J301 incorrectly wired.
Heterodyne frequency oscillator does not operate on any band.	1. Transistor Q6 incorrectly installed or shorted.
Heterodyne frequency oscillator does not operate on one band. (Other bands are OK.)	1. The associated diodes for the inoperative band (D22 thru D29) may be incorrectly installed or shorted. 2. The crystal for the inoperative band may be faulty.

## TROUBLESHOOTING CHART (cont'd.)

CONDITION	POSSIBLE CAUSE
Sidetone does not operate.	1. Diode D21 or IC2 is incorrectly installed or shorted.
Relay does not operate.	1. Transistor Q12 or Q13 is incorrectly installed or shorted.
Relative power meter does not operate.	1. Trimmer capacitors, C95, C99, C103, C106, and C303 are not properly adjusted. 2. Transistor Q8, Q9, or diode D301 are incorrectly installed or shorted.
Relative power meter does not operate on one band only.	1. The trimmer capacitor for that band (C95, C99, C103, or C106) is not properly adjusted. 2. The diode associated with that band is incorrectly installed or shorted. (Diodes D16, D17, D18, D19, D31, D32, D33, D34, D35, D36, D37, or D38.) 3. The heterodyne frequency oscillator is not properly tuned for that band.

# SPECIFICATIONS

## TRANSMITTER

DC Power Input	
80 meters . . . . .	3.5 watts.
40 meters . . . . .	3.0 watts.
20 meters . . . . .	3.0 watts.
15 meters . . . . .	2.5 watts.
Frequency Control . . . . .	Built-in VFO.
Output Impedance . . . . .	50 $\Omega$ unbalanced.
Sidetone . . . . .	Built-in, adjustable volume.
Spurious and Harmonic Levels . . . . .	At least 35 db down.
Transmit Frequency Offset . . . . .	Approximately 750 Hz lower, fixed on all bands.

## RECEIVER

Receiver Type . . . . .	Direct conversion with RF amplifier, balanced product detector, and active audio filter.
Sensitivity . . . . .	1 microvolt or less for 10 dB $\frac{S+N}{N}$ . 0.2 $\mu$ V provides readable signal.
Selectivity . . . . .	Wide — 750 Hz @ 6 dB down. Narrow — 375 Hz @ 6 dB down.
Passband Center Frequency . . . . .	750 Hz.
Type of Reception . . . . .	CW.
Audio Output Impedance . . . . .	1000 $\Omega$ nominal.

## GENERAL

Frequency Coverage . . . . .	80 meters, 3.5 to 3.75 MHz. 40 meters, 7.0 to 7.25 MHz. 20 meters, 14.0 to 14.25 MHz. 15 meters, 21.0 to 21.25 MHz.
Frequency Stability . . . . .	Less than 150 Hz/hour drift after 60 minute warm-up.
Frequency Generation . . . . .	Premixed VFO and HFO.
Power Requirements . . . . .	13.4 volts DC, nominal. 90 mA receive mode, and 430 mA transmit mode.
Dimensions . . . . .	9-1/4" wide x 8-1/2" deep x 4-1/4" high, including knobs and feet. (23.5 cm wide x 21.6 cm deep x 10.8 cm high.)
Weight . . . . .	4 lbs. (1.8 kg.)

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The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

# CIRCUIT DESCRIPTION

Refer to the Schematic Diagram and the Block Diagram in the Illustration Booklet while you read the following description.

The Transceiver operates in the CW portion of the 15, 20, 40, and 80 meter amateur bands. The frequencies are generated by the combined efforts of the VFO and the heterodyne oscillator for both transmit and receive operation. In the following paragraphs, each part of the Transceiver circuitry will be discussed in detail.

## VFO

FET (field effect transistor) Q2 and its associated circuitry forms a Hartley oscillator. Part of coil L9, tuning capacitor C302, and temperature compensating capacitors C44, C45, C46, C47, C48, C49, and C51 determine the frequency of the oscillator. The other part of L9 is a feedback circuit that couples part of the generated signal back to the gate of FET Q2 to help sustain oscillation. The VFO generates frequencies from 8.645 MHz to 8.895 MHz.

Diode D9 clamps the positive-going half of the signal to prevent FET Q2 from reaching high peak operating currents. This helps to keep the VFO from generating harmonic frequencies.

The signal from the VFO is coupled through capacitor C54 and C56 to emitter follower transistor Q3. This transistor provides isolation for the VFO. The output from the emitter of transistor Q3 is coupled to the balanced mixer.

When the Transmitter is keyed, diode D11 effectively adds capacitor C55 to the circuit which causes a shift in the VFO frequency. This produces a fixed offset during transmit. Zener diode ZD1 provides voltage regulation for the drain of FET Q2.

## HFO

The HFO operates at any of four crystal-controlled frequencies, depending on which band switch is depressed. These frequencies, when mixed with the VFO frequency, establish the four bands of operation.

When the 3.5 MHz pushbutton switch on the front panel is depressed, crystal Y1 and its associated circuitry are electrically connected to transistor Q6 to form the HFO. At this time power is supplied to the circuit through resistor R78 and crystal Y1 oscillates at a frequency of 12.395 MHz, which is coupled through diode D22 to transistor Q6. A part of the signal from the collector of transistor Q6 is coupled back through diode D23 and through the tuned circuit composed of coil L17 and capacitor C116 to sustain oscillation. Diodes D22 and D23 prevent DC from activating this crystal circuit when a different crystal circuit is being used. The HFO operates similarly on the other bands.

The HFO signal is coupled through capacitor C127 to emitter follower transistor Q7. This transistor provides isolation for the oscillator circuit to prevent loading. From the emitter of transistor Q7, the signal is coupled to the balanced mixer.

## BALANCED MIXER

Coils L11 and L12 and diodes D12, D13, D14, and D15 form a balanced mixer which combines the VFO and HFO signals. This produces four signals at the output of the balanced mixer. These are the VFO frequency plus the HFO frequency, the HFO frequency minus the VFO frequency, the VFO frequency, and the HFO frequency. The only frequency that we are concerned with is the HFO frequency minus the VFO frequency.

## MIXER AMPLIFIER

The four signals are then coupled through capacitor C61 to FET Q4 where they are amplified and then coupled to the four diode-selected filter circuits. Only one filter circuit is electrically connected to the circuit on any one band. For example, if the 3.5 MHz pushbutton switch on the front panel is depressed, coil L13 and capacitor C64 are electrically connected to the circuit. This tuned circuit filters out the three unwanted signals and leaves only the "on-frequency" signal, which is coupled through capacitor C73 to transistor Q5.

Transistor Q5 is connected as an emitter follower which provides isolation and impedance matching. The output from the emitter of Q5 is coupled through C75 to transistor Q8 and also through capacitor C28 to balanced product detector IC1.

## TRANSMITTER

The output of driver transistor Q8 is resonance-tuned by the appropriate diode-switched tuned circuit. Here again, there are four tuned circuits. Only one tuned circuit is electrically connected to the output of Q8 for each band of operation. For the 3.5 MHz band, coil L22 and capacitor C77 and C78 are connected through diodes D31 and D35.

The output from the driver is coupled to final amplifier transistor Q9. Here the signal is amplified and then coupled through the appropriate switch (part of the depressed front panel switch) to the output circuit, which acts as a bandpass filter and impedance matching network.

Zener diode ZD2 prevents excessive collector RF voltage from destroying transistor Q9 if the operator should mistakenly key the transmitter when there is no load present on the output of the Transmitter, or when the SWR is high.

Capacitor C303 is the Loading control and is adjusted for maximum power on the relative power meter. The RF power output is then coupled through antenna switching relay RL1 and to antenna jack J302. A small part of the RF power output is coupled through resistor R302, and capacitor C304 to the relative power meter. This output power is rectified by diode D301.

## KEYING

Transistor Q11 provides a keying function when the key is depressed. This transistor provides the keying for the transmitter driving stage, the sidetone oscillator, the break-in delay switching, and the receiver muting. When the key is depressed, the keying transistor places a B+ voltage on the collector of driver transistor Q8 and switches it on. The transmitter is then keyed and provides an RF output signal.

Also, when the key is depressed, pin 11 of sidetone oscillator IC2D is connected to ground through resistor R72 and diode D21 and the key to cause the oscillator to turn on and generate an audible tone. This tone is coupled through capacitor C111, resistor R76, Sidetone Level Adjust control R77, and capacitor C113 to the headphone jack.

## BREAK-IN DELAY

Transistors Q12 and Q13 provide an adjustable delay circuit for antenna switching and receiver muting. The emitter of break-in delay transistor Q12 is connected to ground when the key is depressed. This effectively puts the collector of Q12 at ground potential, which causes relay driver transistor Q13 to energize relay RY1 and switch the antenna from receive to transmit. Relay RY1 will remain energized until the base voltage of relay driver transistor Q13 increases to the B+ voltage. The key also turns transistor Q11 on and off which switches the Transceiver between transmit and receive.

The B+ voltage at the relay is used to switch VFO offset diode D11 to provide offset during transmit and also to switch the mute transistor Q14 on. This effectively connects the input of the audio preamplifier stage to ground, thus muting the receiver during transmit.

When the key is released, the emitter and collector voltages of Q12 try to increase toward B+. However, at this time, capacitor C92 is discharging through delay control R68, which keeps the relay energized. After capacitor C92 has discharged and the voltage on the collector of Q13 returns to normal, the relay opens. The amount of time required for capacitor C92 to discharge is adjustable through delay control R68.

## RECEIVER CIRCUITS

The signals received by the antenna are coupled through RF Gain control R302 and through the appropriate front panel pushbutton switch (for example we will say the 3.5 MHz band switch). From here, the signal is coupled through coil L1 and diode D1 to RF amplifier Q1. Coil L1 and capacitors C1, C3, and C301A form a resonant circuit. Diode D1 provides the electrical switching to connect the signal to FET Q1 when the 3.5 MHz switch is depressed.

The signal is amplified by FET Q1 and is filtered by one of the coil-capacitor networks. (Each network serves as a filter for one of the four bands.) This filtered signal is then coupled through capacitor C25 to pin 1 of IC1, the balanced product detector. IC1 mixes the premixed VFO signal with the received signal to produce an audio signal. This signal is present at pin 9 of IC1 and is coupled through capacitors C33, C35, and resistor R19 to pin 3 of IC2A.

IC2A and IC2B are active audio filters. The audio signal passes through these two stages of audio filtering, which removes any RF signal and produces an audio signal that has good audio bandwidth and excellent skirt selectivity. There are two stages of audio selectivity which are selected by Selectivity switch SW302 on the front panel.

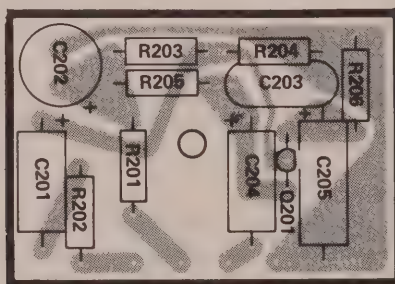
From the Selectivity switch, the signal is coupled through capacitor C38 to IC2C. IC2C is an audio preamplifier which amplifies the signal and then couples it through resistor R202 and capacitor C201 to transistor Q201. Transistor Q201 further amplifies the signal and then it is coupled through capacitor C204 to headphone jack J301.

# CIRCUIT BOARD

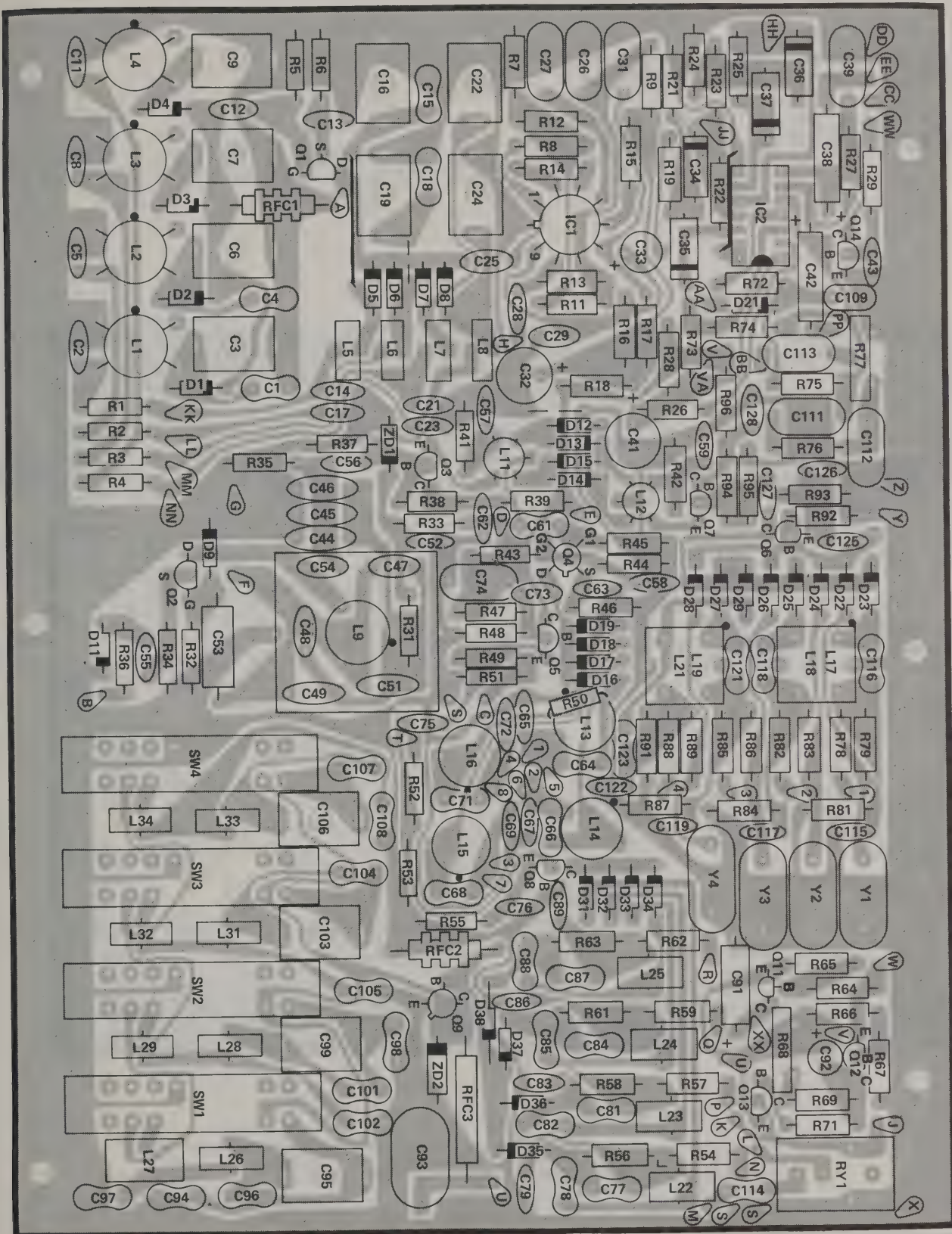
## X-RAY VIEWS

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

- A. Find the circuit component number (R5, C3, etc.) on the "Circuit Board X-Ray Views."
- B. Locate this same number in the "Circuit Component Number" column of the "Parts List" in the front of this Manual.
- C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.

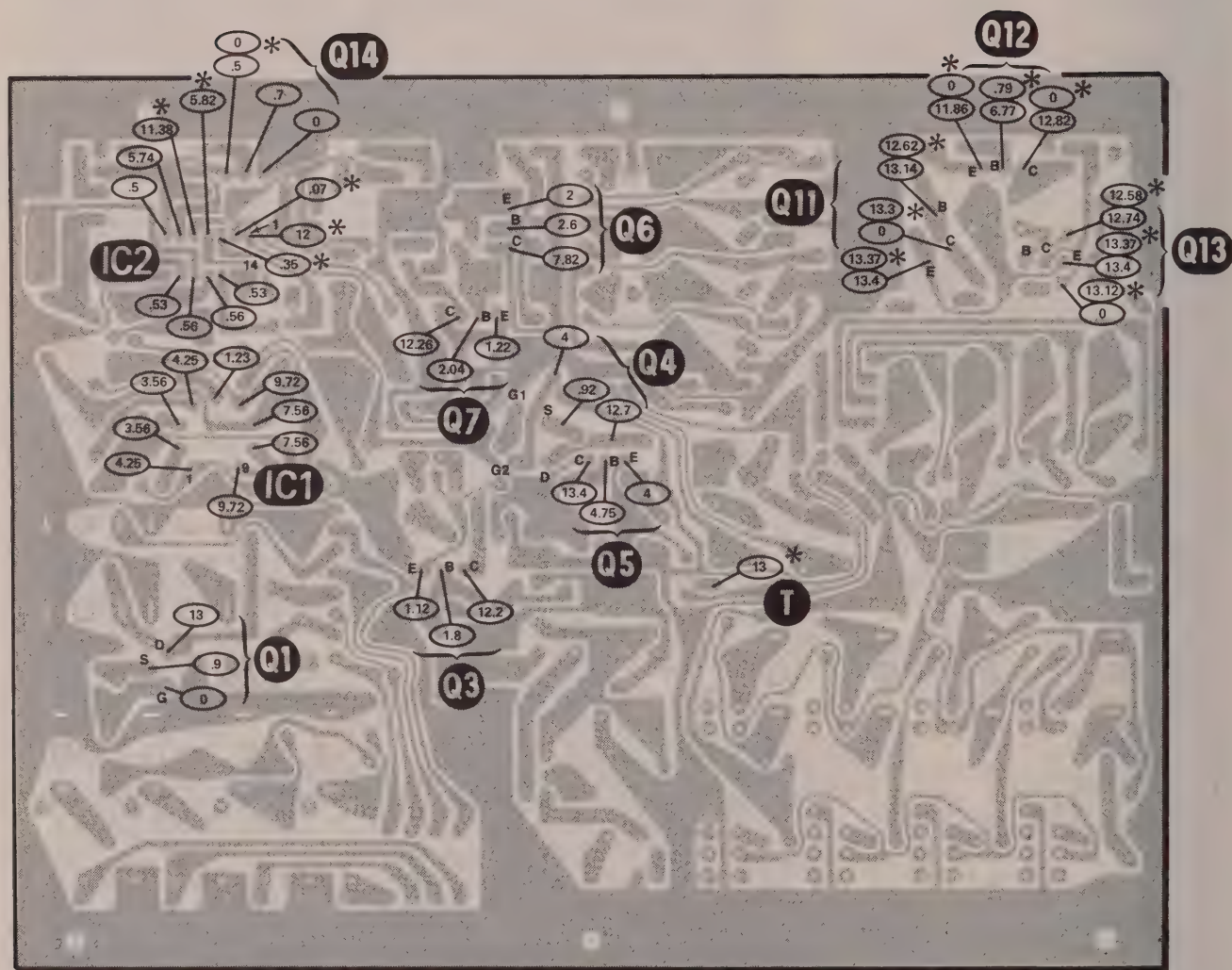


AF AMPLIFIER CIRCUIT BOARD  
(Viewed from foil side)



MAIN CIRCUIT BOARD  
(Viewed from foil side)

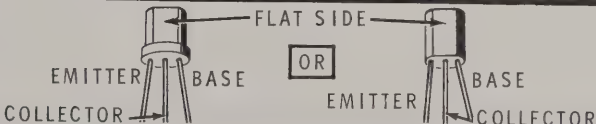
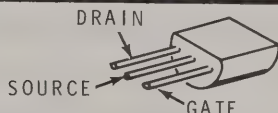
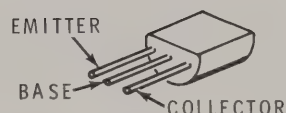
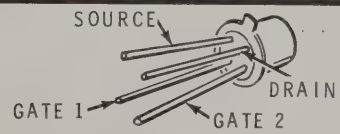
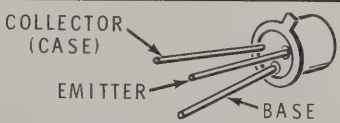
# CIRCUIT BOARD VOLTAGE CHART



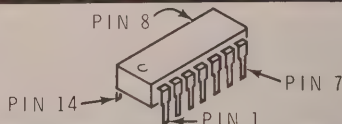
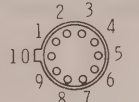
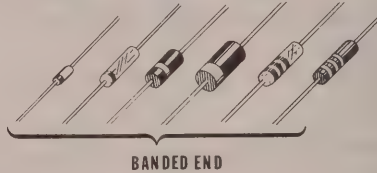
○ THIS SYMBOL INDICATES A RECEIVE-MODE DC VOLTAGE MEASURED FROM THE POINT INDICATED TO CHASSIS.

○\* THIS SYMBOL INDICATES A TRANSMIT-MODE DC VOLTAGE MEASURED FROM THE POINT INDICATED TO CHASSIS.

# IDENTIFICATION CHART

COMPONENT	HEATH PART NUMBER	TYPE NUMBER	IDENTIFICATION
Q13	417-201	X29A829	
Q1, Q2	417-169	MPF105	
Q11	417-116	S2091	
Q6, Q8	417-172	MPS-6521	
Q3, Q5, Q7, Q12, Q14, Q201	417-801	MPS-A20	
Q4	417-240	40673	
Q9	417-880	2N4427	

## IDENTIFICATION CHART (Cont'd)

COMPONENT	HEATH PART NUMBER	TYPE NUMBER	IDENTIFICATION
IC2	442-71	LM3900	
IC1	442-96	MC1496	 (BOTTOM VIEW)
ZD1	56-19	VR-9.1	<p><b>IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.</b></p> 
ZD2	56-55	VR-36	
D12, D13, D14, D15	56-87	FH100	
D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D16, D17, D18, D19, D21, D31, D32, D33, D34, D35, D36, D37, D38	56-24	1N458	
D22, D23, D24, D25, D26, D27, D28, D29,	56-56	1N4149	



**FOR PARTS REQUESTS ONLY**

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

**DO NOT WRITE IN THIS SPACE****INSTRUCTIONS**

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, \$3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.  
Total enclosed \$ \_\_\_\_\_
- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_ ZIP \_\_\_\_\_

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # \_\_\_\_\_ Invoice # \_\_\_\_\_

Date \_\_\_\_\_ Location \_\_\_\_\_

Purchased \_\_\_\_\_ Purchased \_\_\_\_\_

LIST <b>HEATH</b> PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE

TOTAL FOR PARTS

HANDLING AND SHIPPING

MICHIGAN RESIDENTS ADD 4% TAX

TOTAL AMOUNT OF ORDER

SEND TO: **HEATH COMPANY**  
BENTON HARBOR  
MICHIGAN 49022  
**ATTN: PARTS REPLACEMENT**

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY  
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

**FOR PARTS REQUESTS ONLY**

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

**DO NOT WRITE IN THIS SPACE****INSTRUCTIONS**

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Total enclosed \$ \_\_\_\_\_
- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_ ZIP \_\_\_\_\_

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Model # \_\_\_\_\_ Invoice # \_\_\_\_\_

Date \_\_\_\_\_ Location \_\_\_\_\_

Purchased \_\_\_\_\_ Purchased \_\_\_\_\_

LIST <b>HEATH</b> PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE

TOTAL FOR PARTS

HANDLING AND SHIPPING

MICHIGAN RESIDENTS ADD 4% TAX

TOTAL AMOUNT OF ORDER

SEND TO: **HEATH COMPANY**  
BENTON HARBOR  
MICHIGAN 49022  
**ATTN: PARTS REPLACEMENT**

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY  
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

CUT ALONG DOTTED LINE

# CUSTOMER SERVICE

## REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

## ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company  
Benton Harbor  
MI 49022  
Attn: Parts Replacement

**Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.**

## OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

## TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

**Please do not send parts for testing**, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

## REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

**If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.**

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least **THREE INCHES** of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company  
Service Department  
Benton Harbor, Michigan 49022

HEATH

**Schlumberger**

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***THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM***

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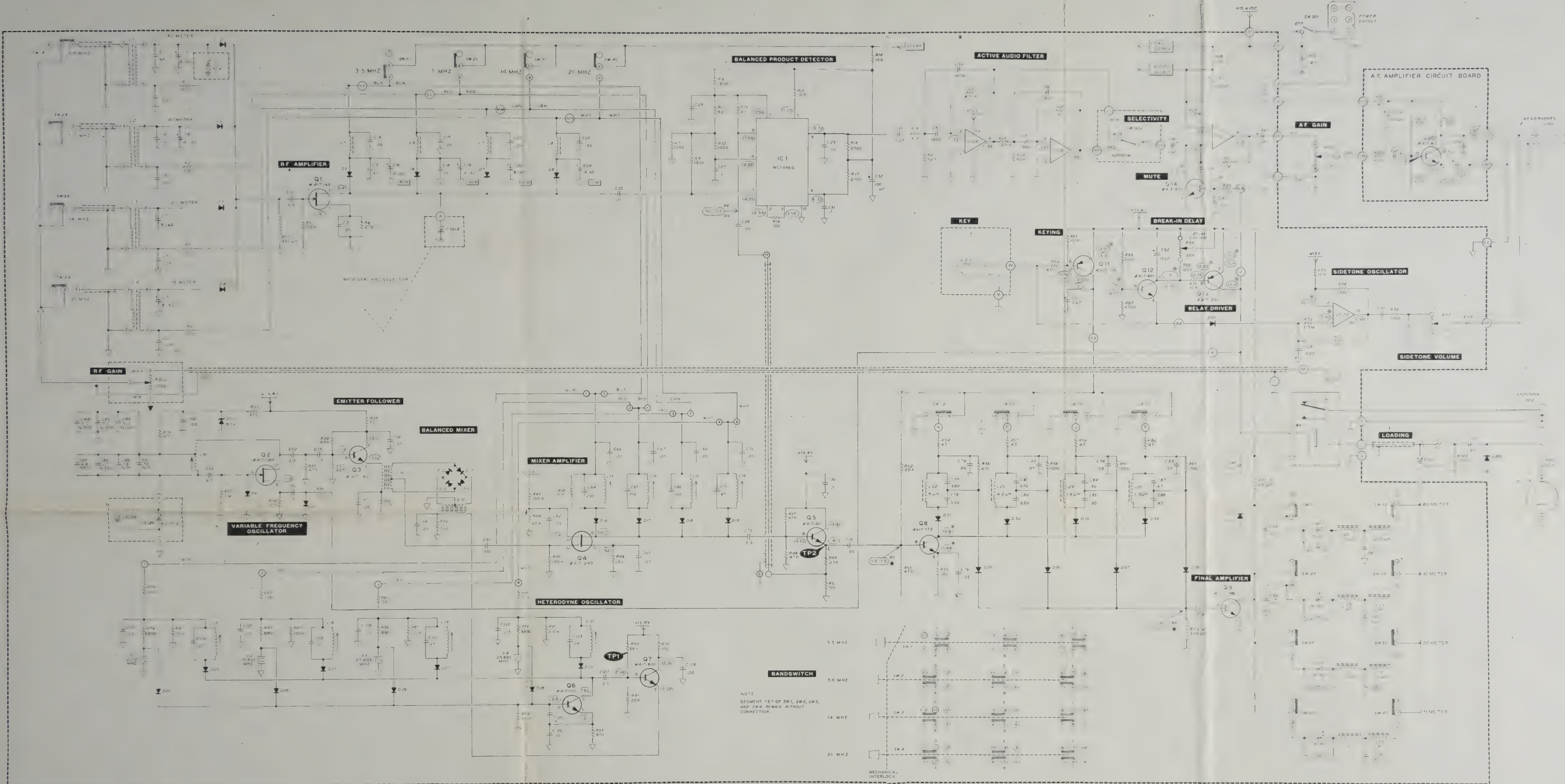


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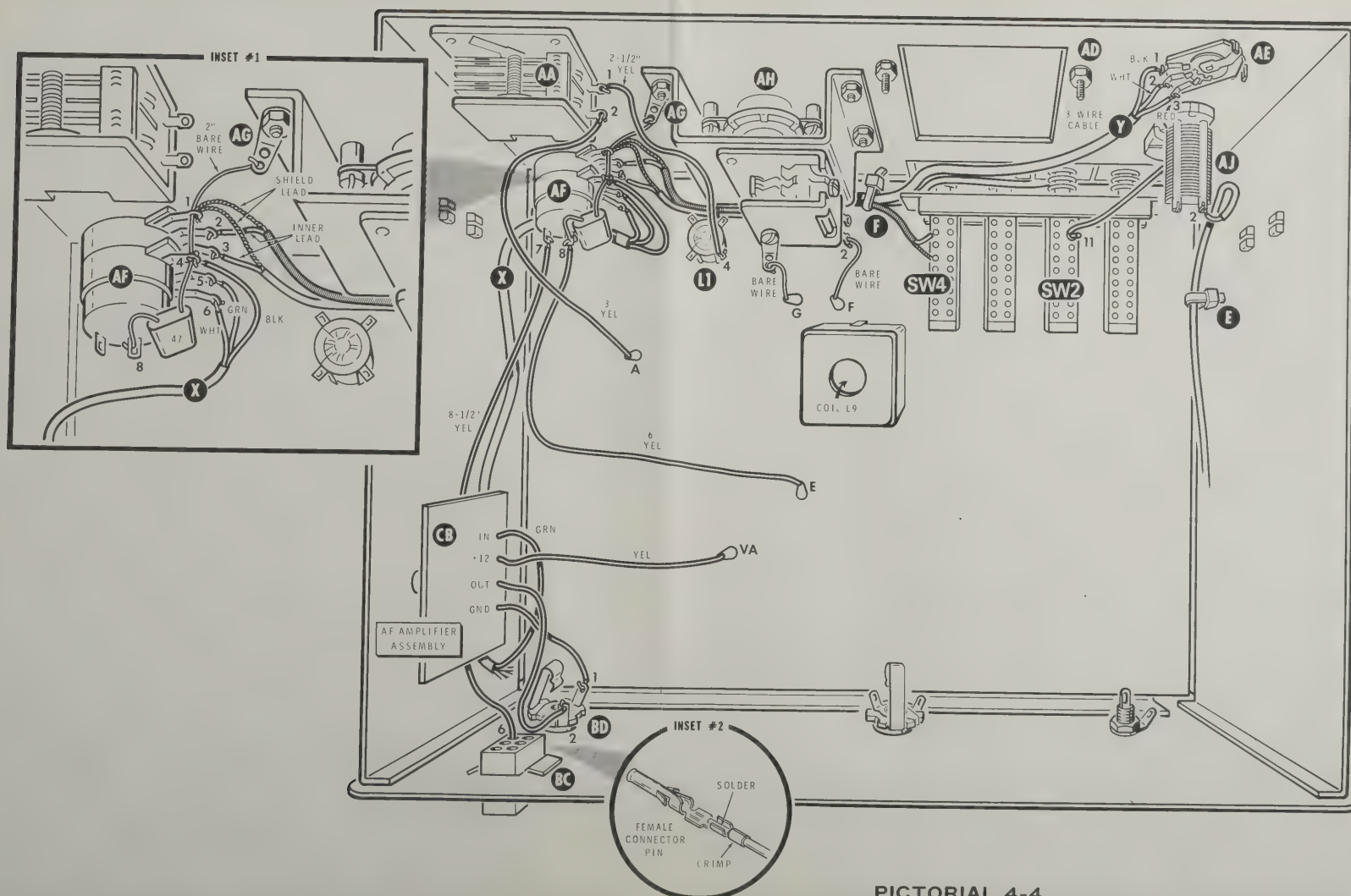
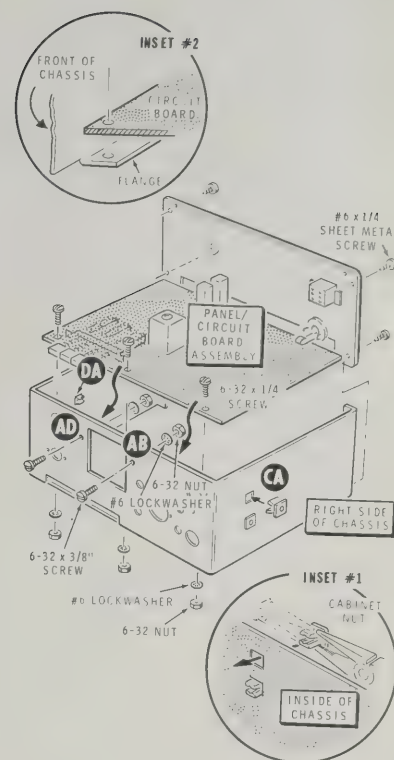
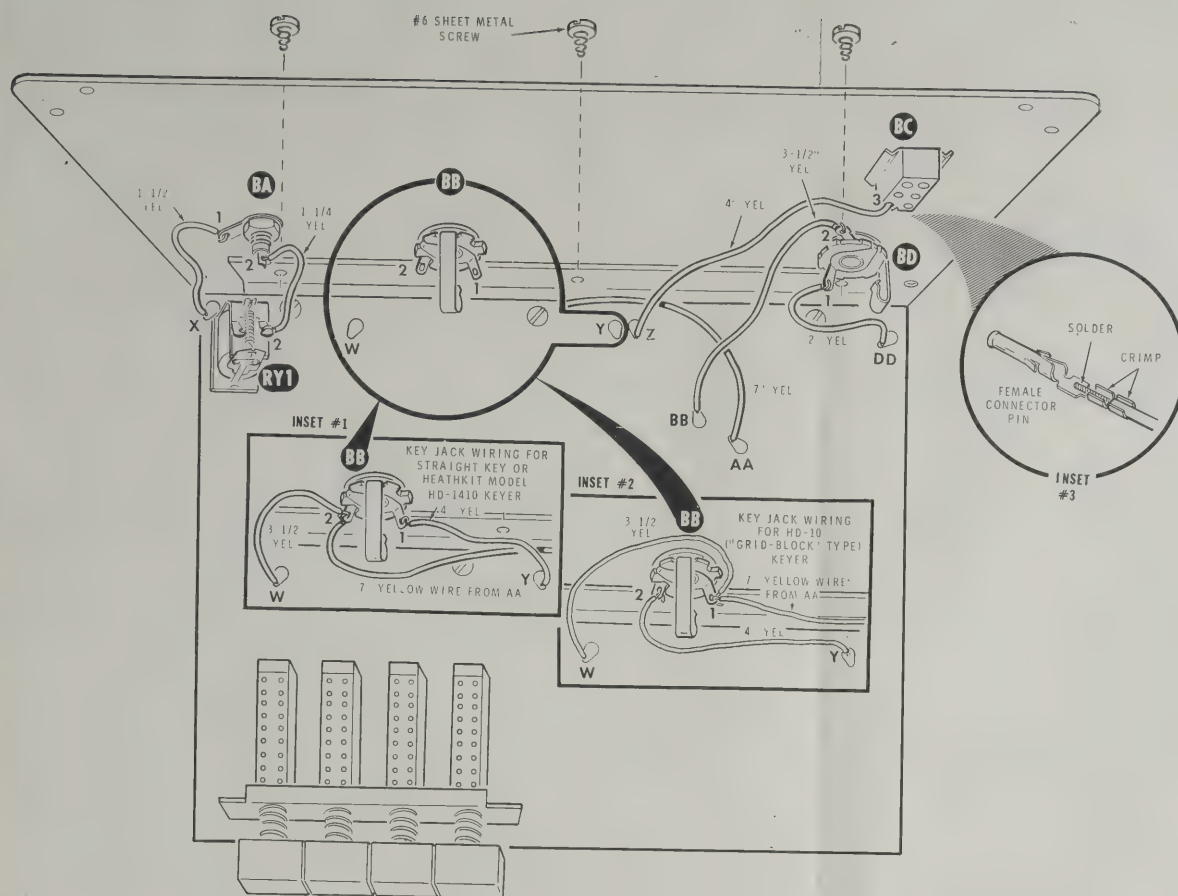
SCHEMATIC OF THE  
HEATHKIT  
MODEL HW-8  
TRANSCIVER

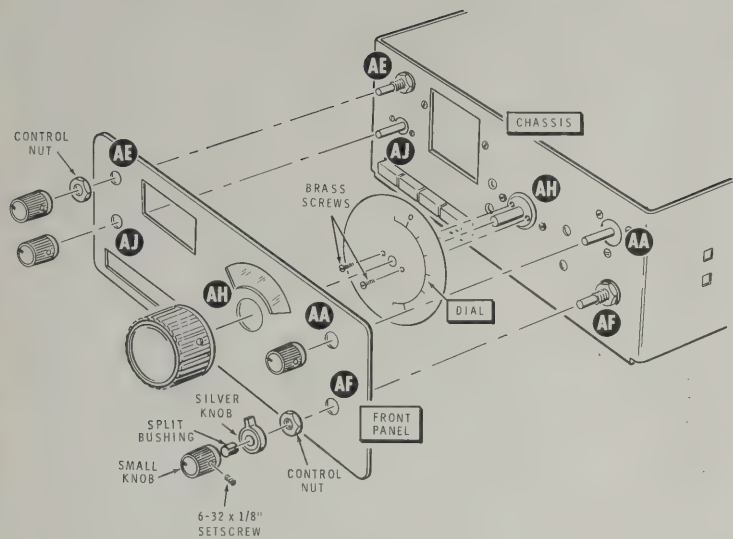
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Part of I-595-1754-07

- This symbol indicates a RECEIVE-MODE DC VOLTAGE MEASUREMENT POINT AS INDICATED TO CHASSIS.
- \* This symbol indicates a TRANSMIT-MODE DC VOLTAGE MEASUREMENT POINT AS INDICATED TO CHASSIS.

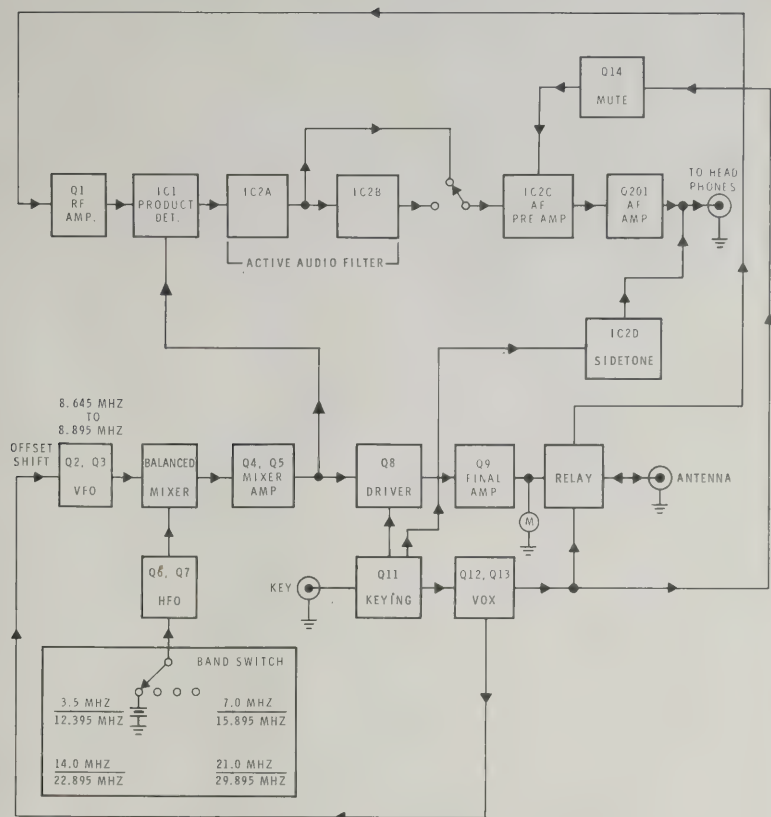
- RF This symbol indicates a RECEIVE-MODE RF VOLTAGE MEASUREMENT POINT AS INDICATED TO CHASSIS.
- RF\* This symbol indicates a TRANSMIT-MODE RF VOLTAGE MEASUREMENT POINT AS INDICATED TO CHASSIS.

- AV This symbol indicates a VOLTAGE MEASURED WITH A HIGH INPUT IMPEDANCE VOLTMETER. VOLTAGES MAY VARY ±20%.
- 1 All measurements obtained using a power source of 13.8V.
- 2 Bandswitch shown with 3.5 MHz pushbutton pressed in and transceiver operating in receive mode.

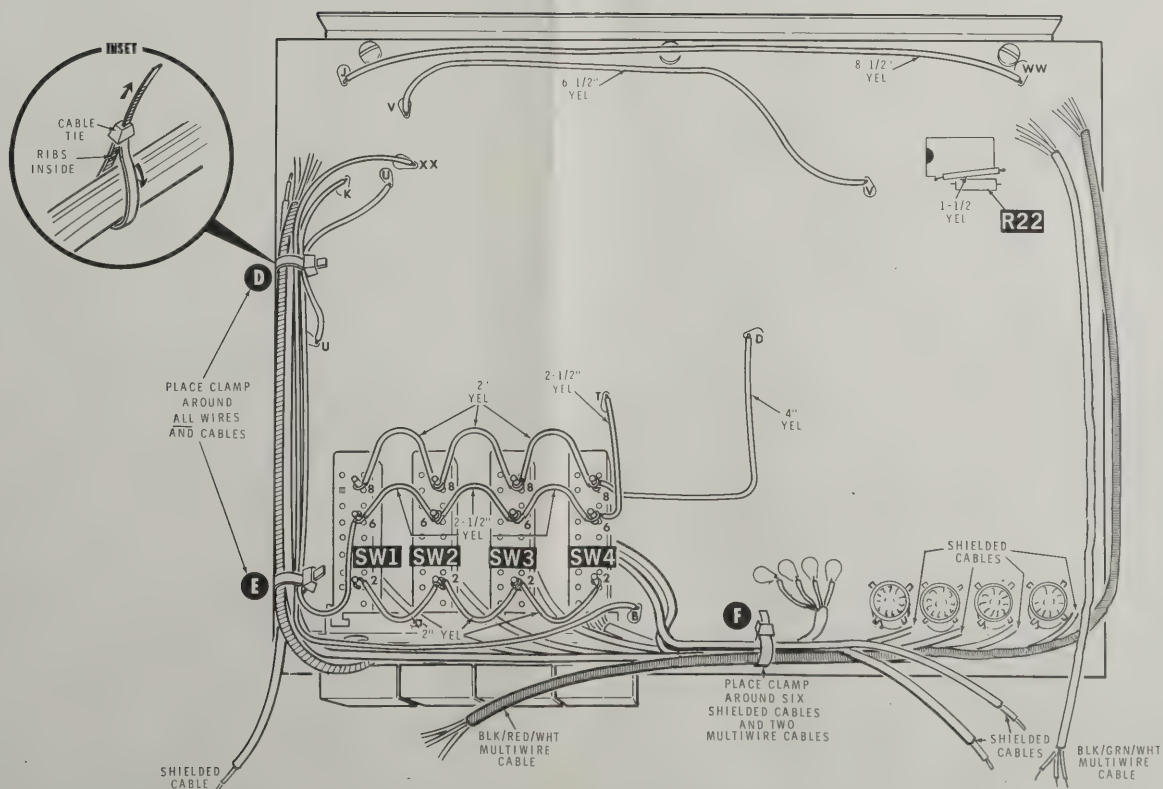




PICTORIAL 4-5



BLOCK DIAGRAM



PICTORIAL 3-3

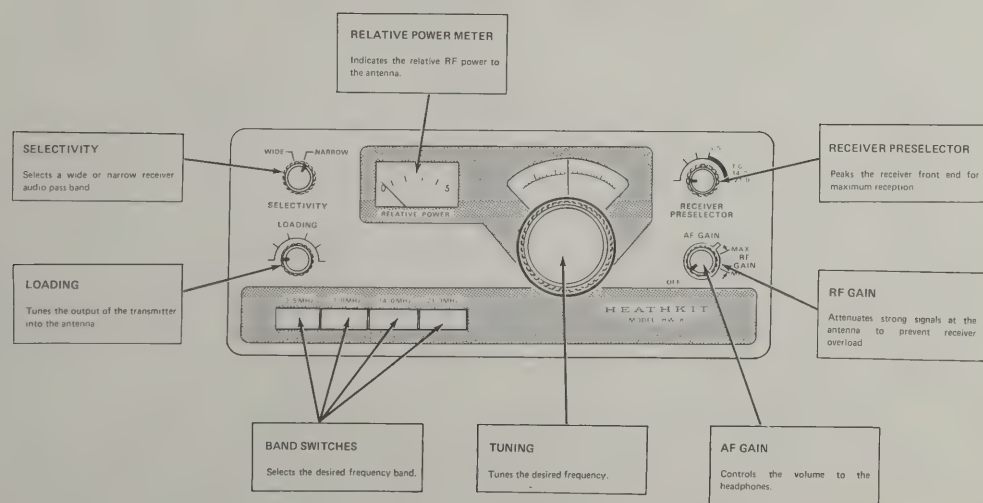
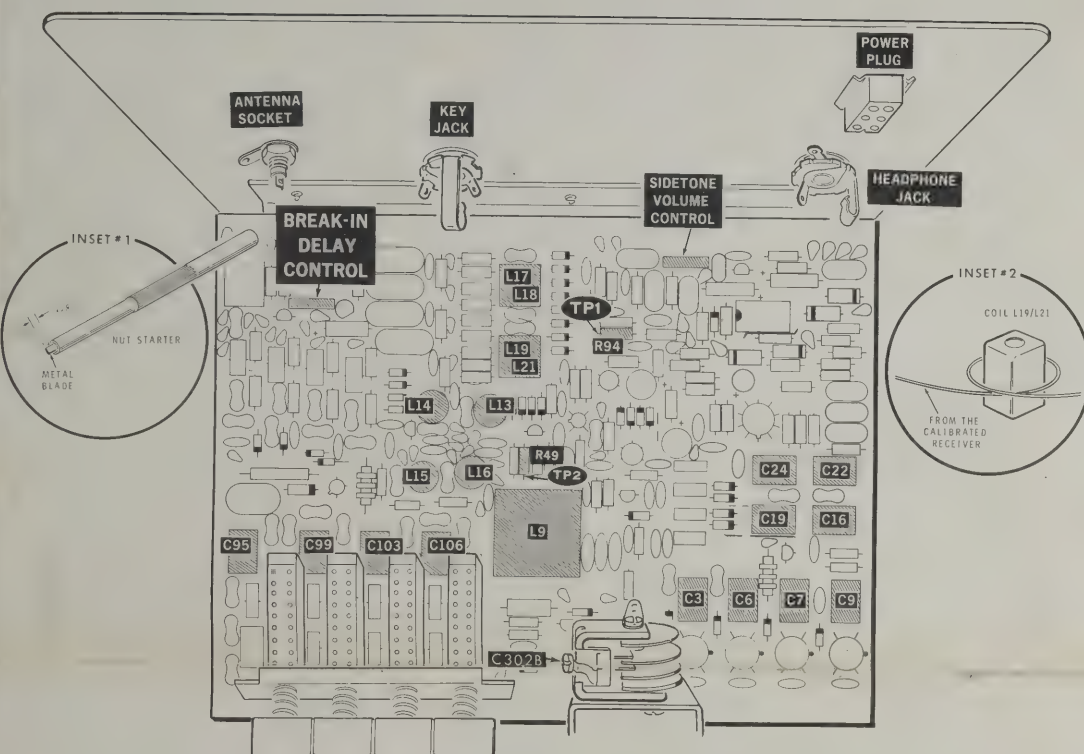
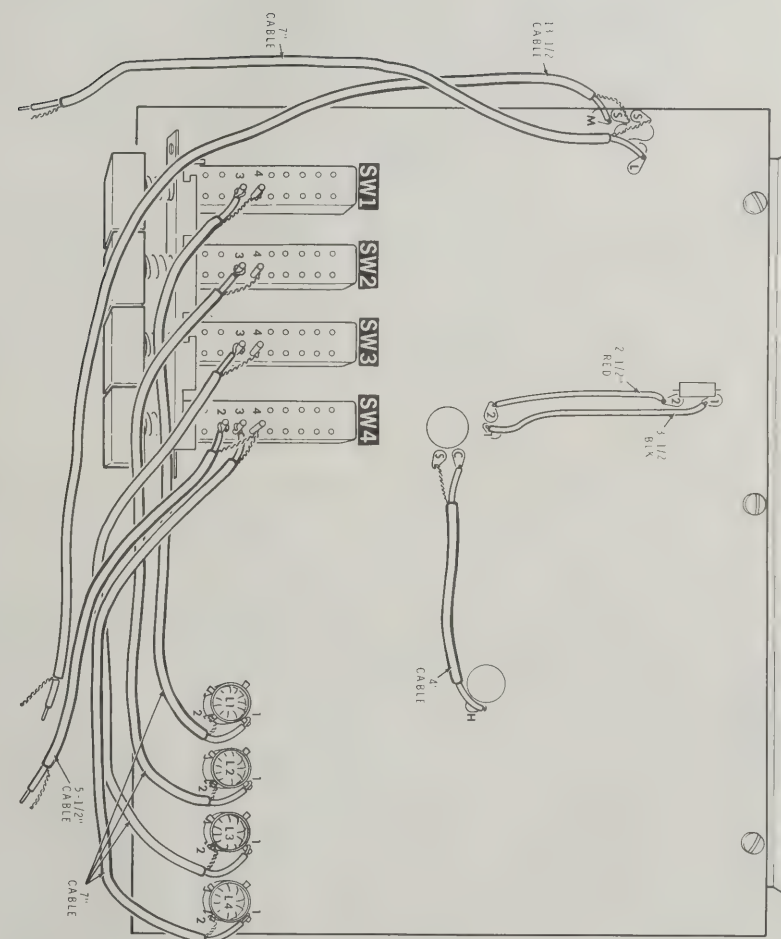


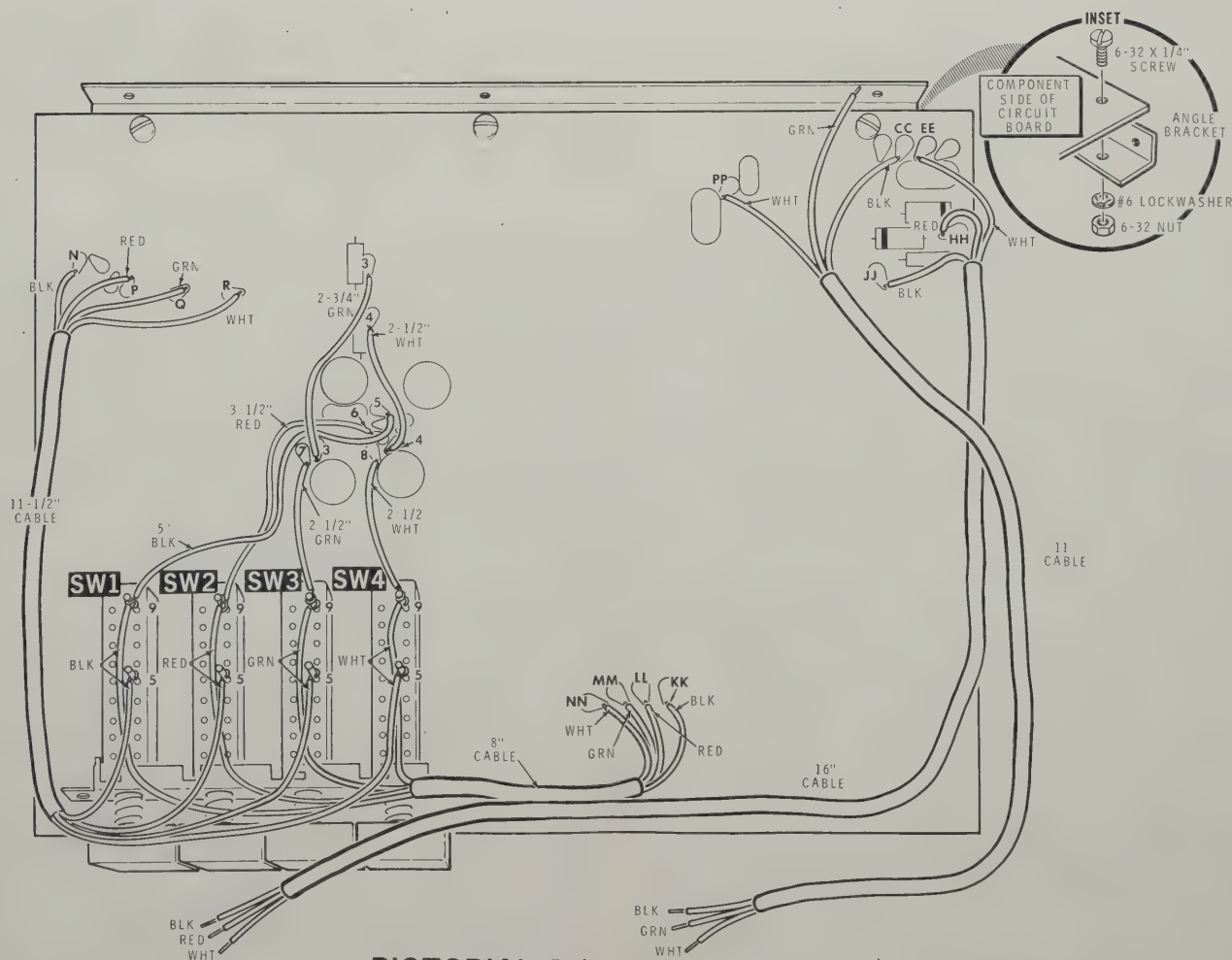
Figure 1-2

PICTORIAL 3-2



# ILLUSTRATION BOOKLET

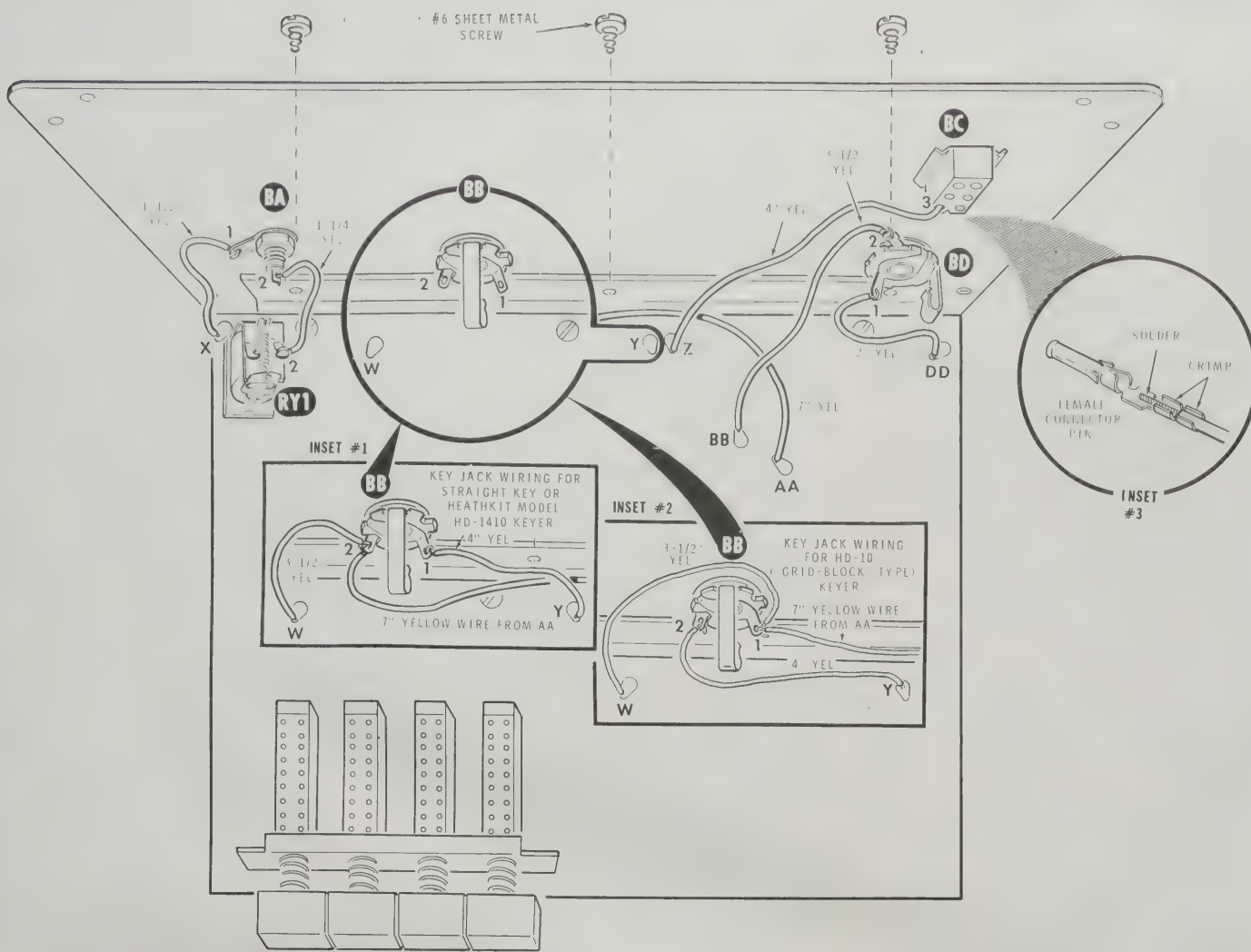
Part of I-595-1754-07



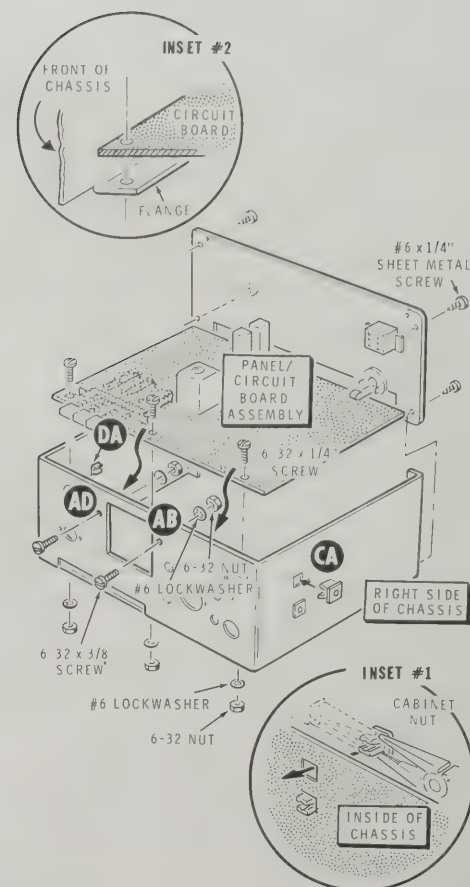
PICTORIAL 3-1

MODEL HW-8

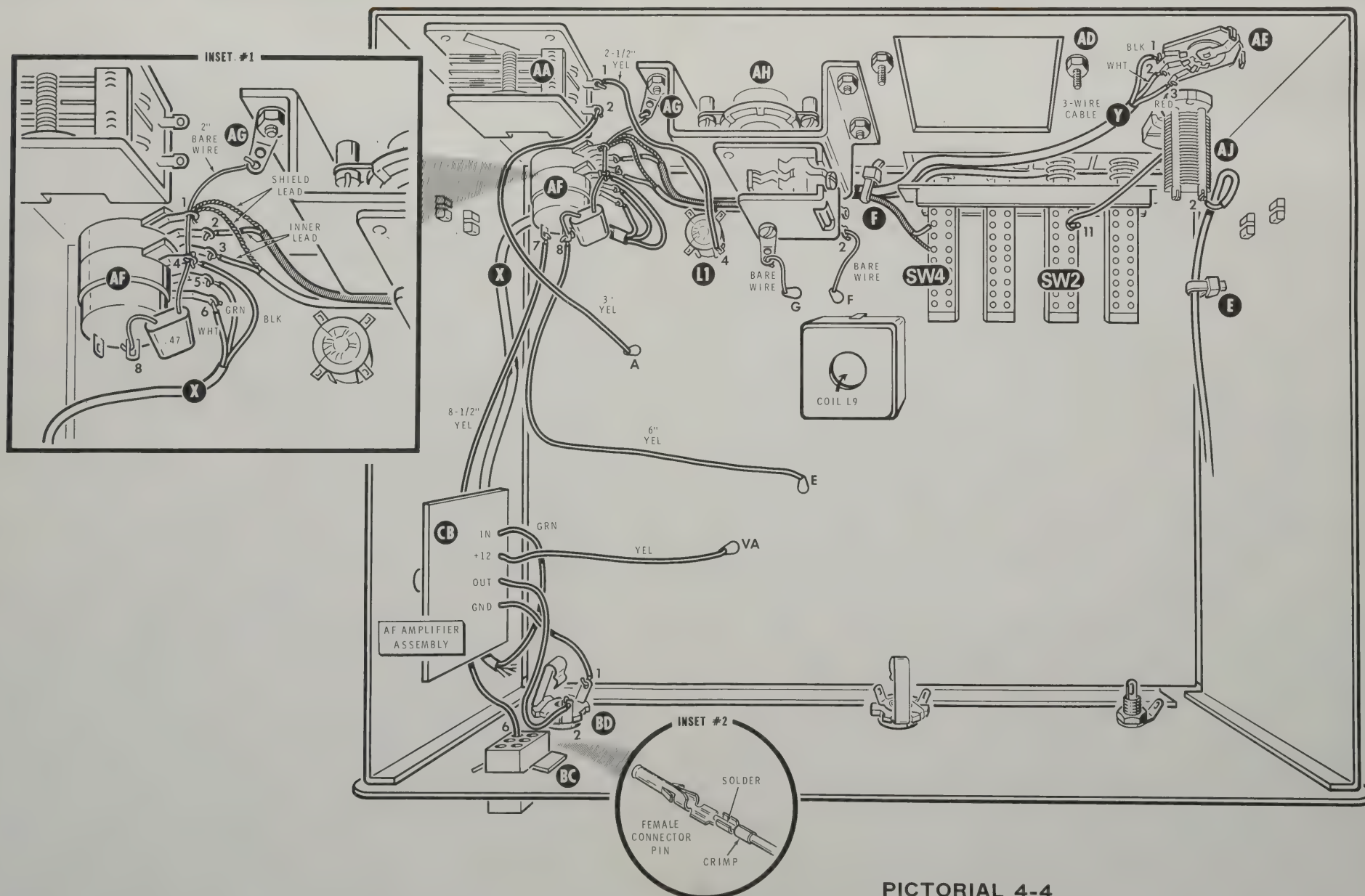
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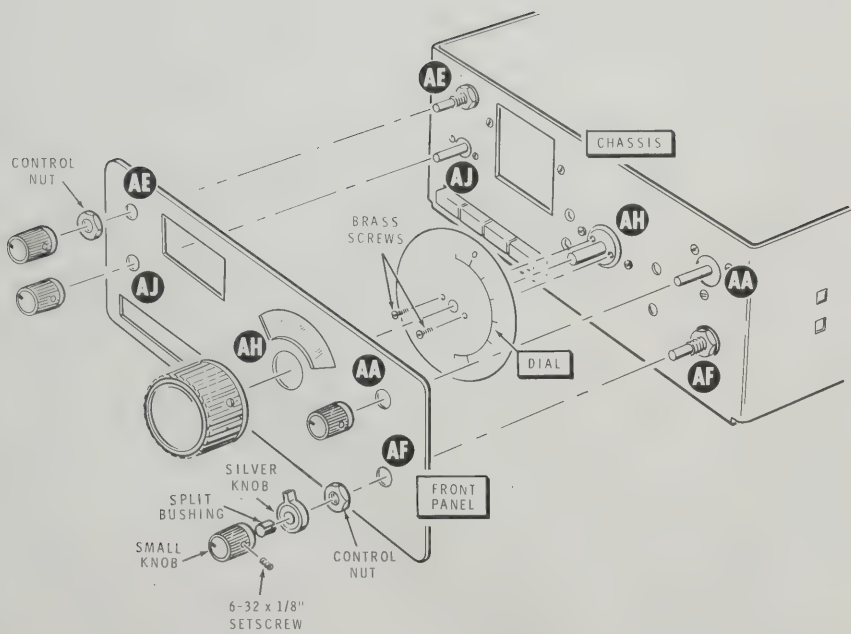
PICTORIAL 4-2



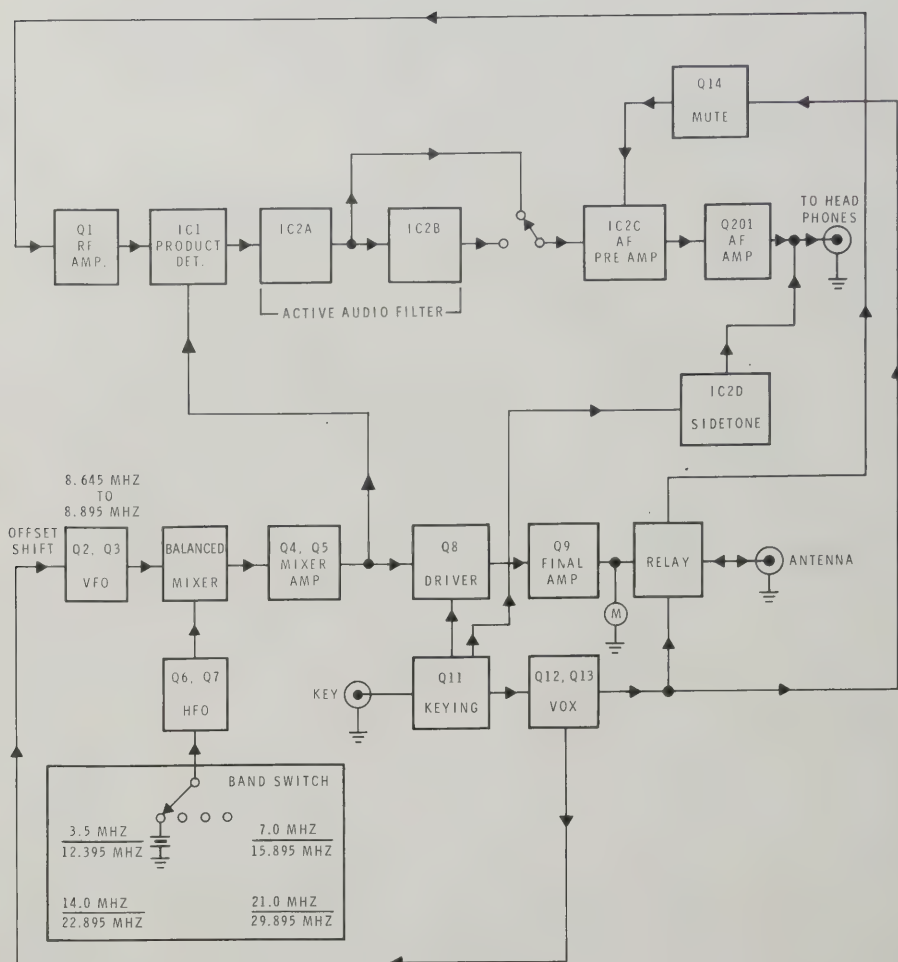
PICTORIAL 4-3



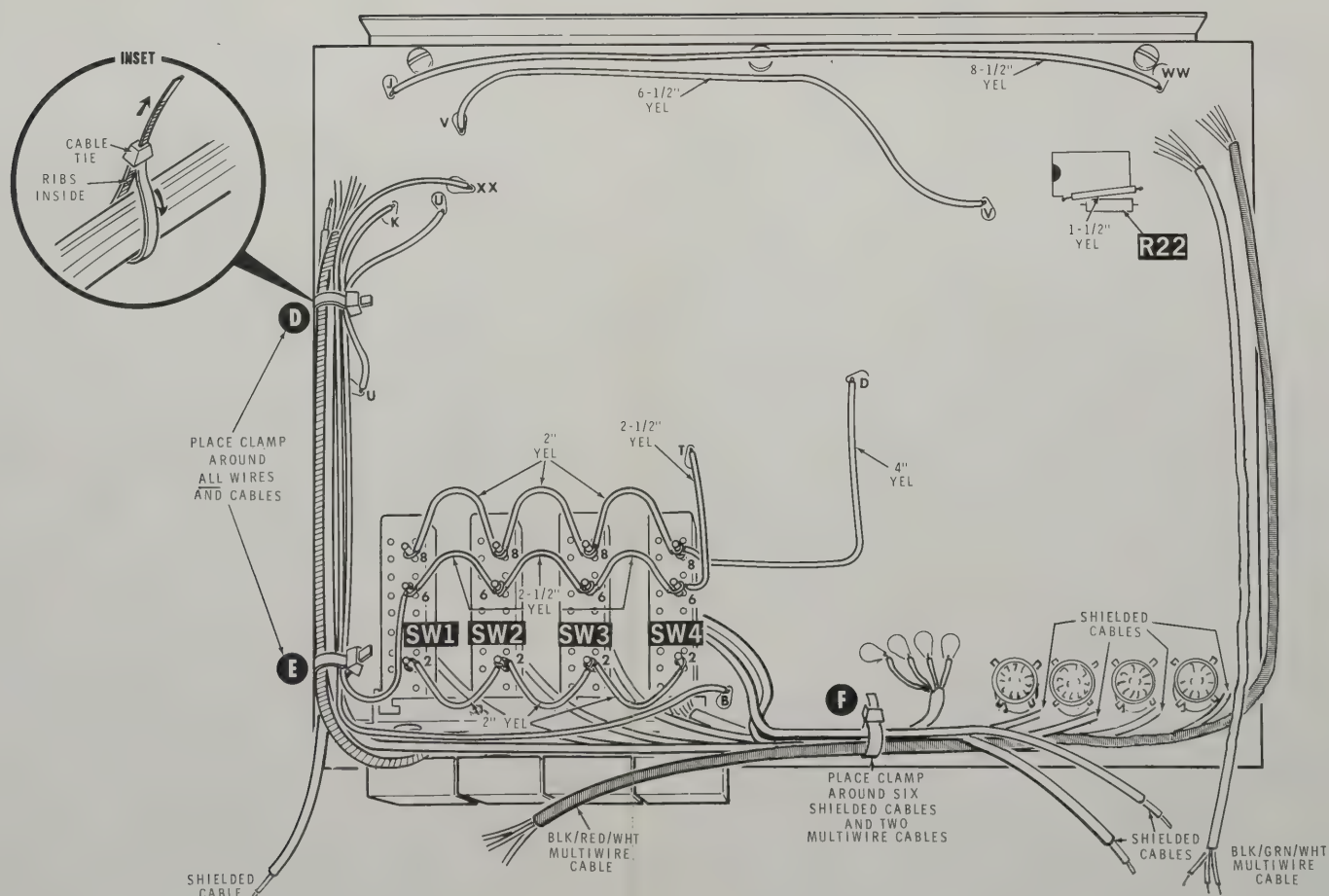
PICTORIAL 4-4



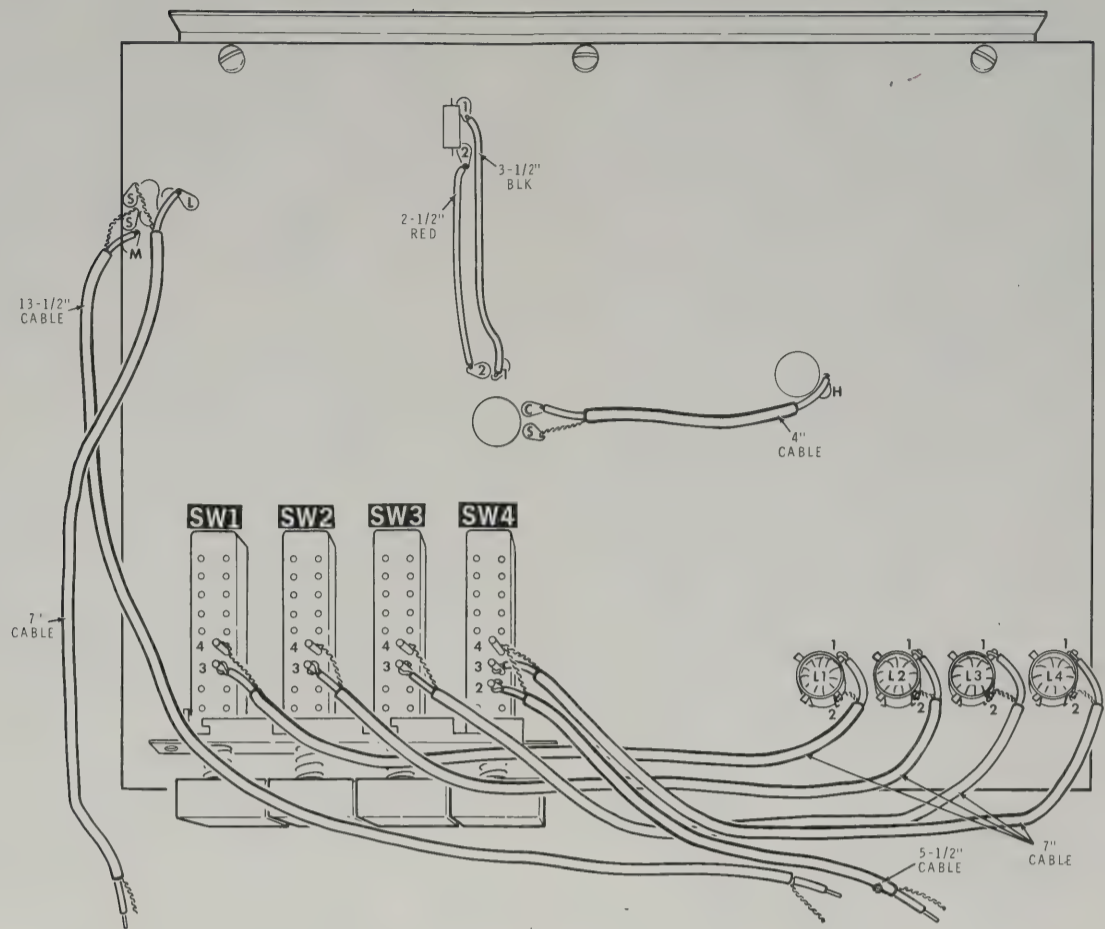
PICTORIAL 4-5



BLOCK DIAGRAM



PICTORIAL 3-3



PICTORIAL 3-2

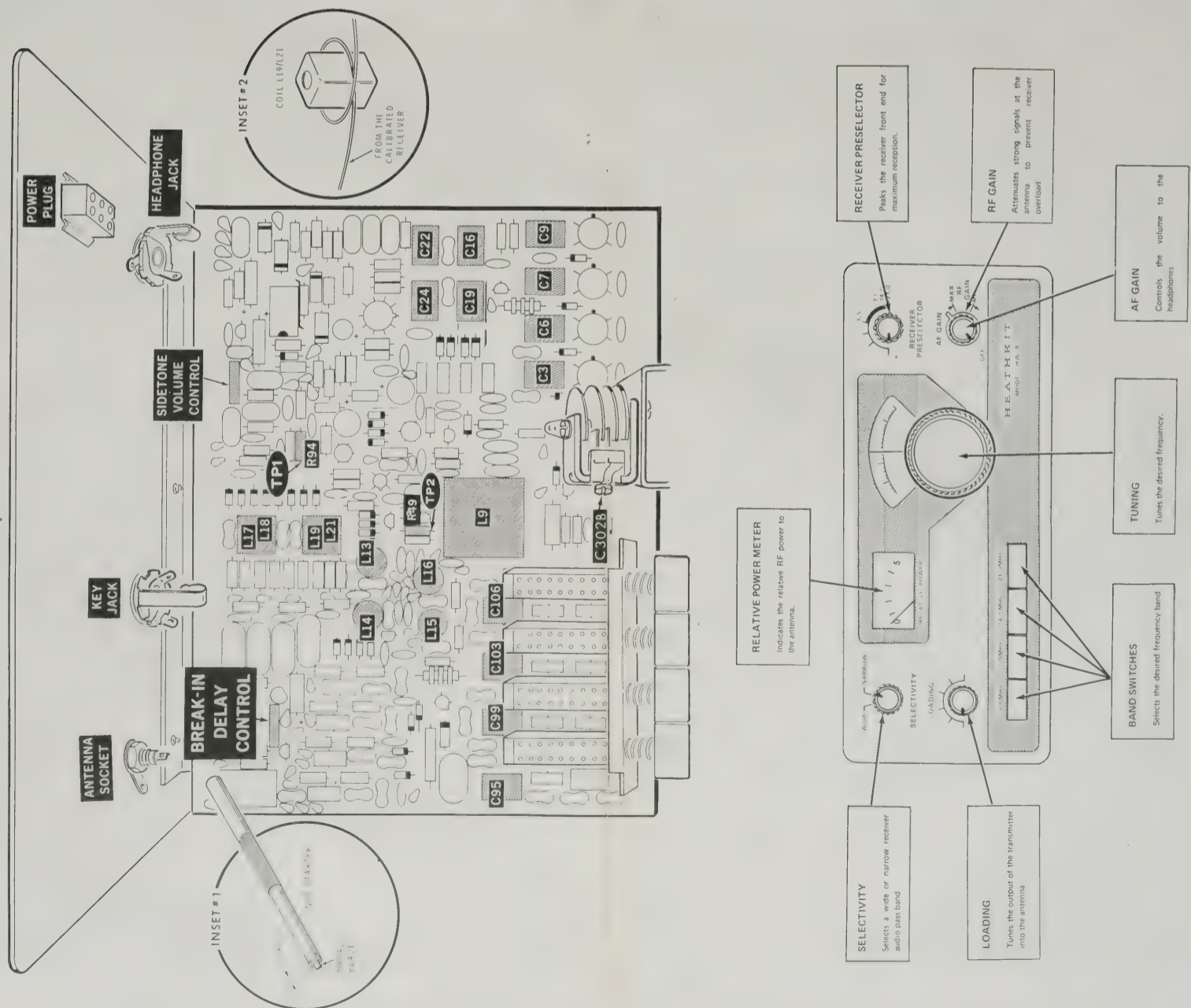
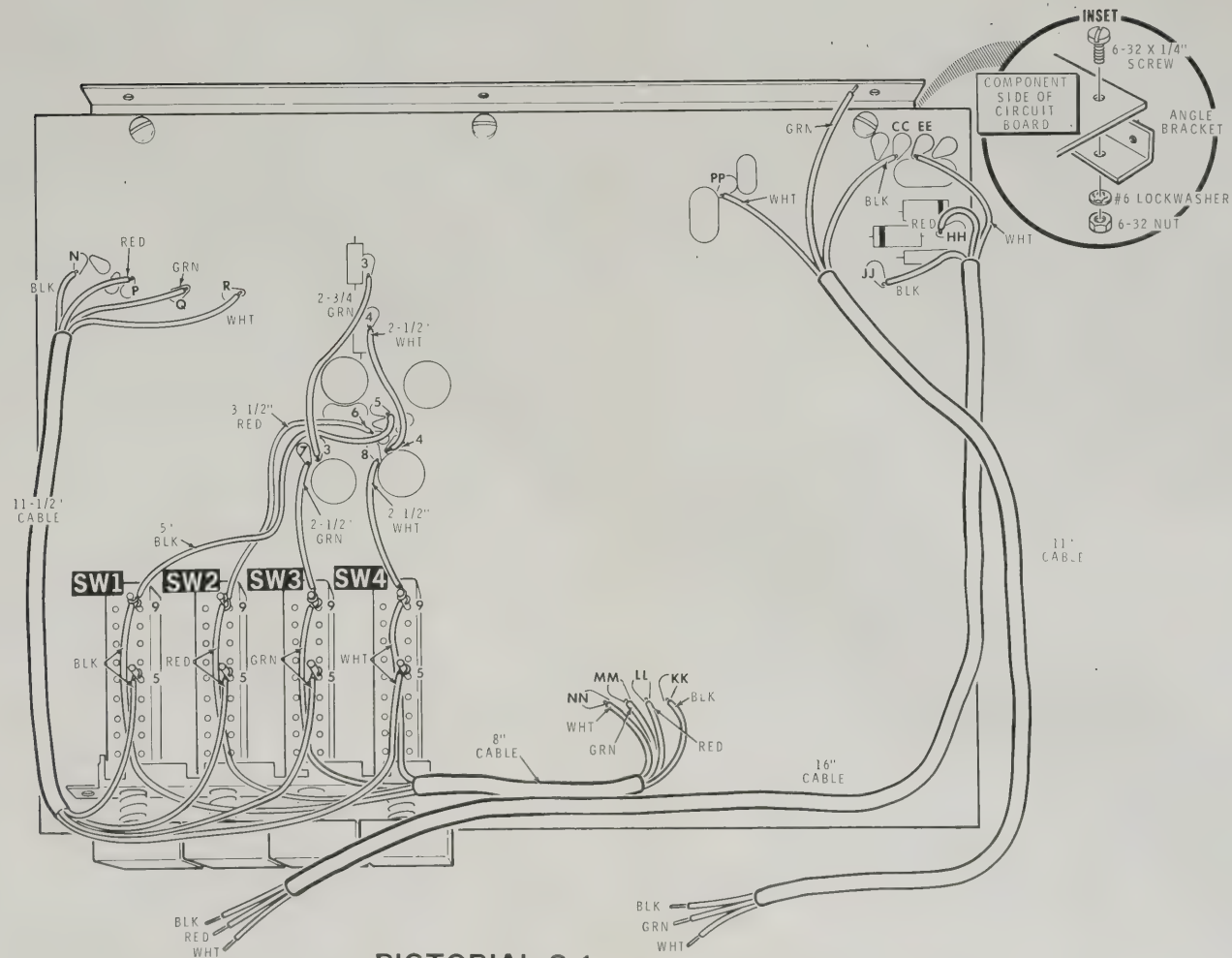


Figure 1-2

# ILLUSTRATION BOOKLET

Part of 595-1754-09



PICTORIAL 3-1

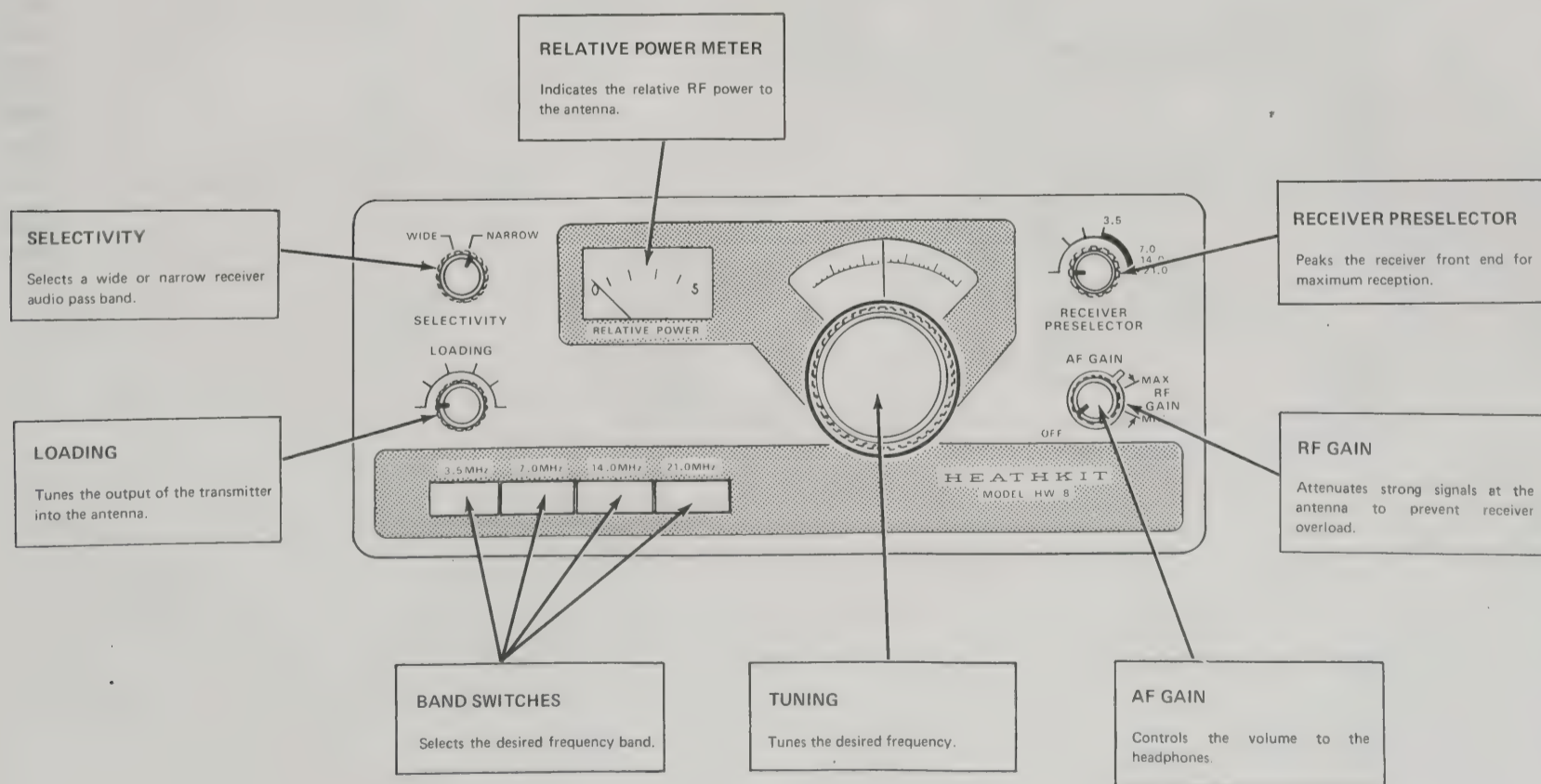
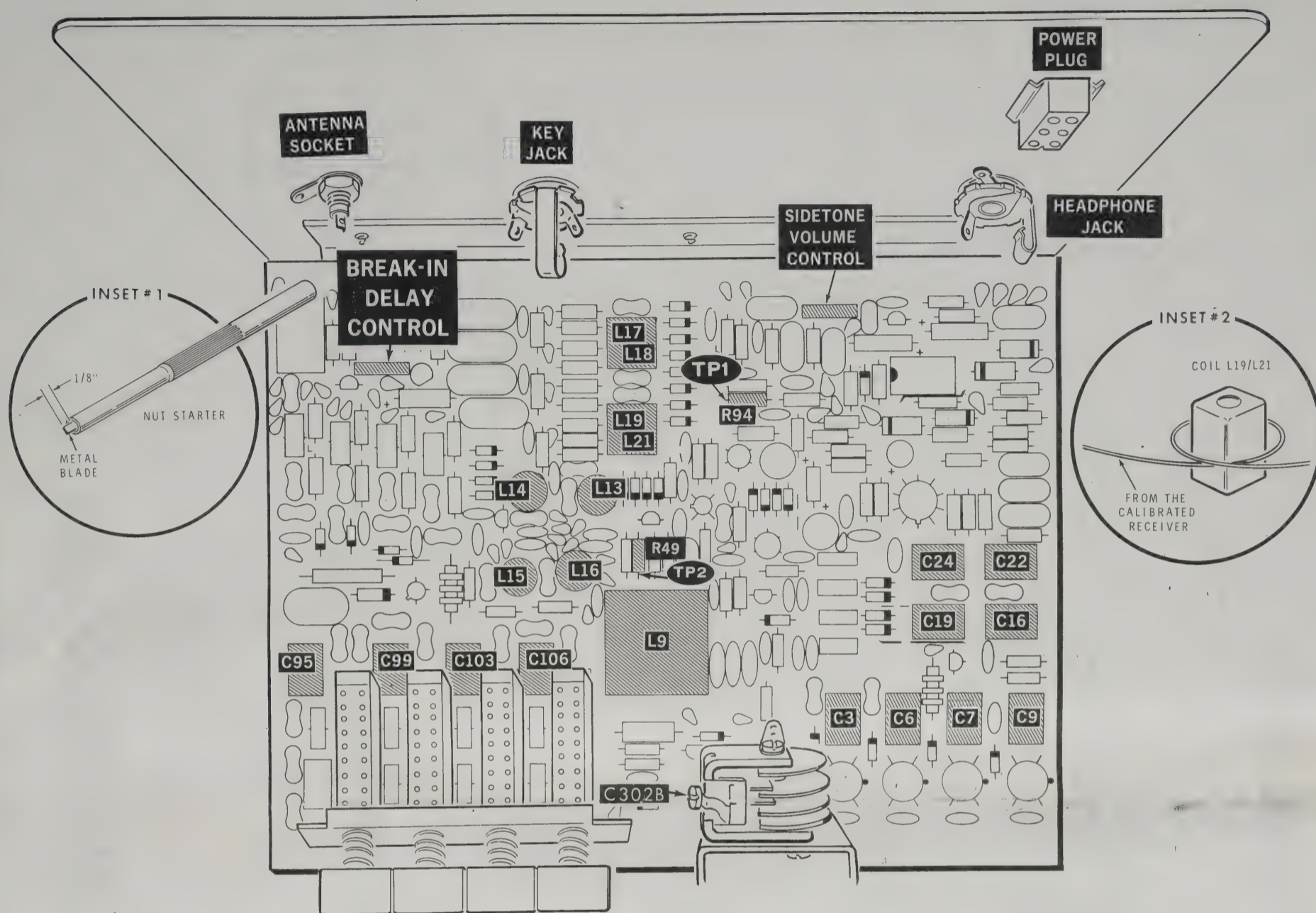
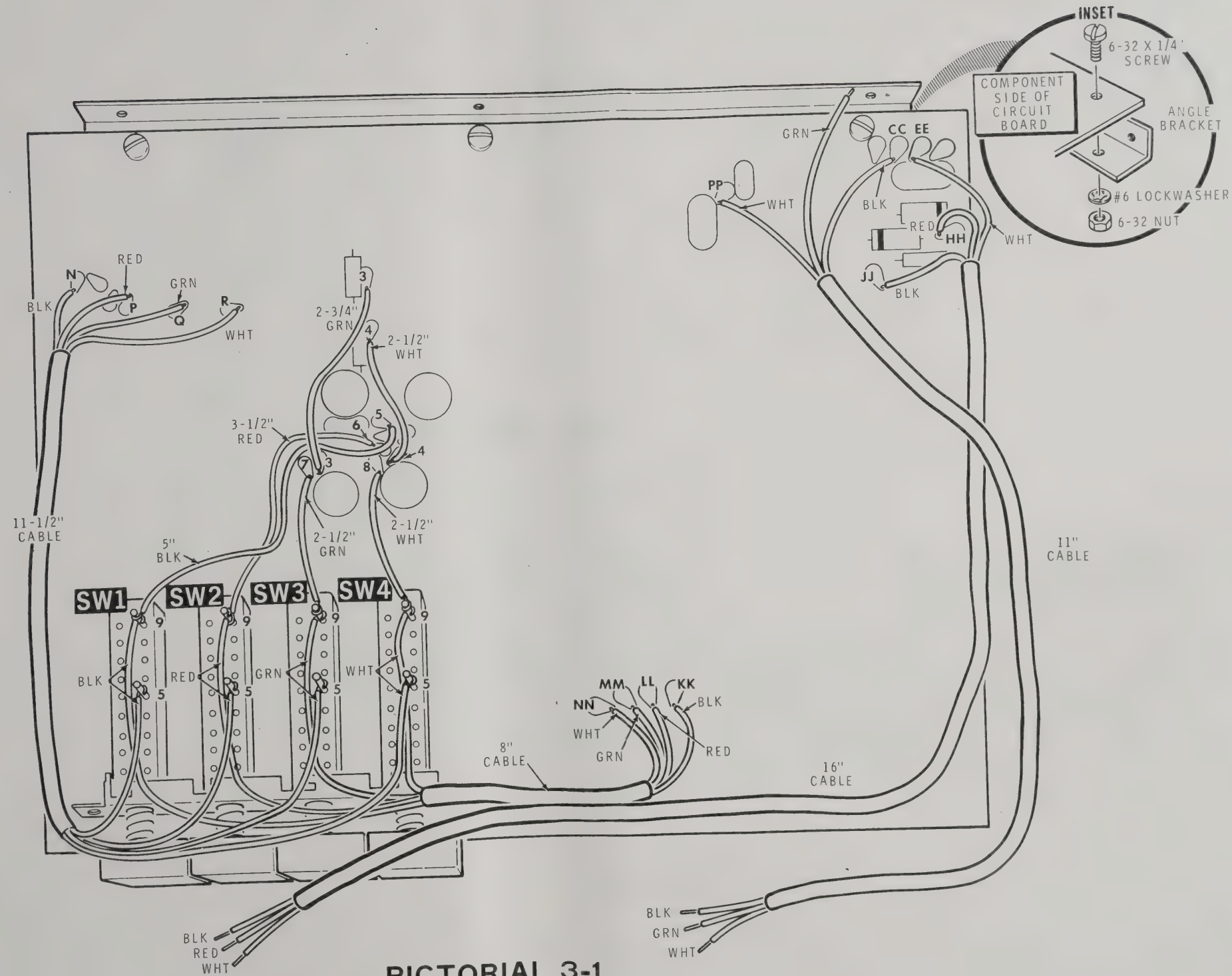


Figure 1-2

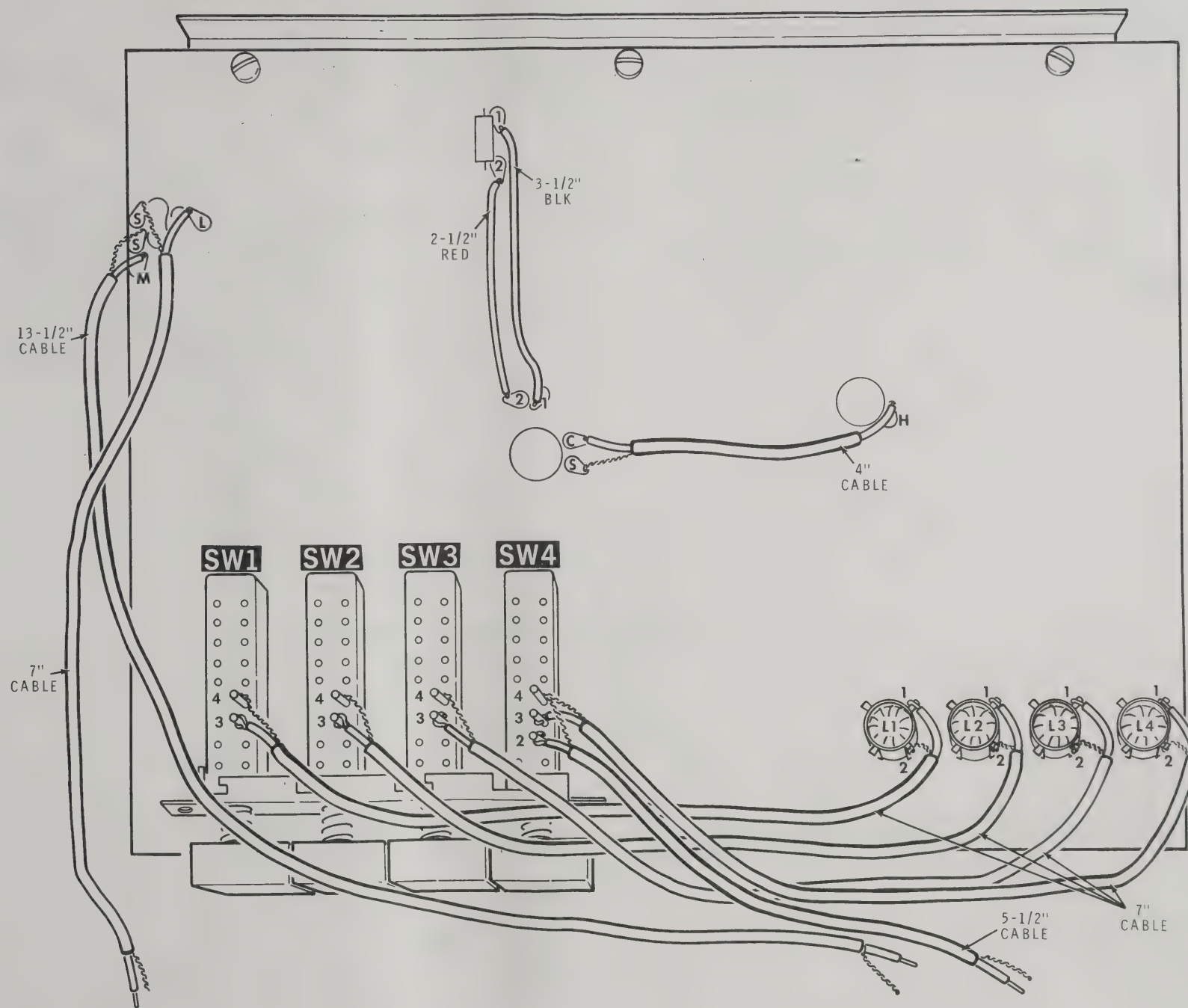
# ILLUSTRATION BOOKLET

Part of I-595-1754-07

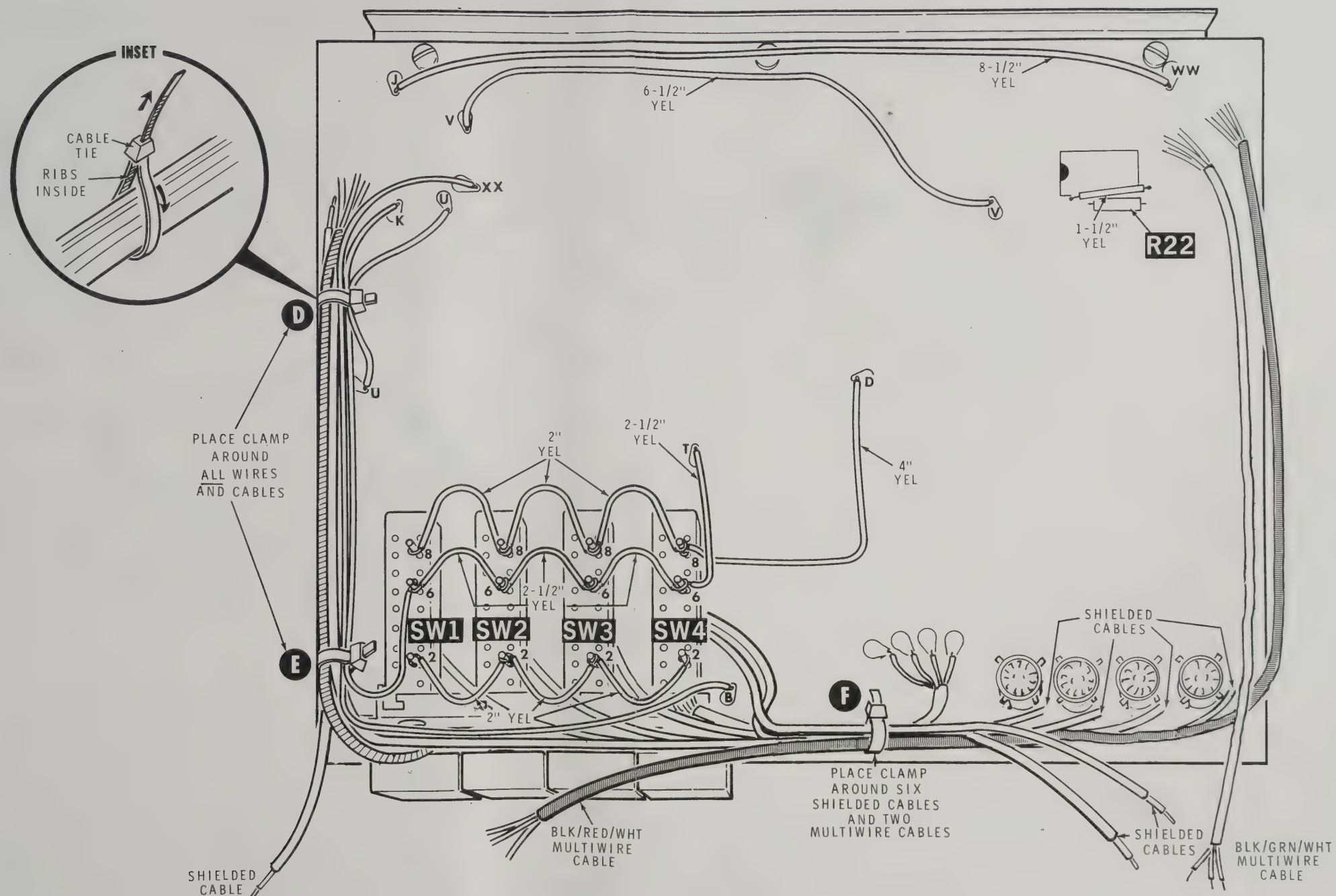


PICTORIAL 3-1

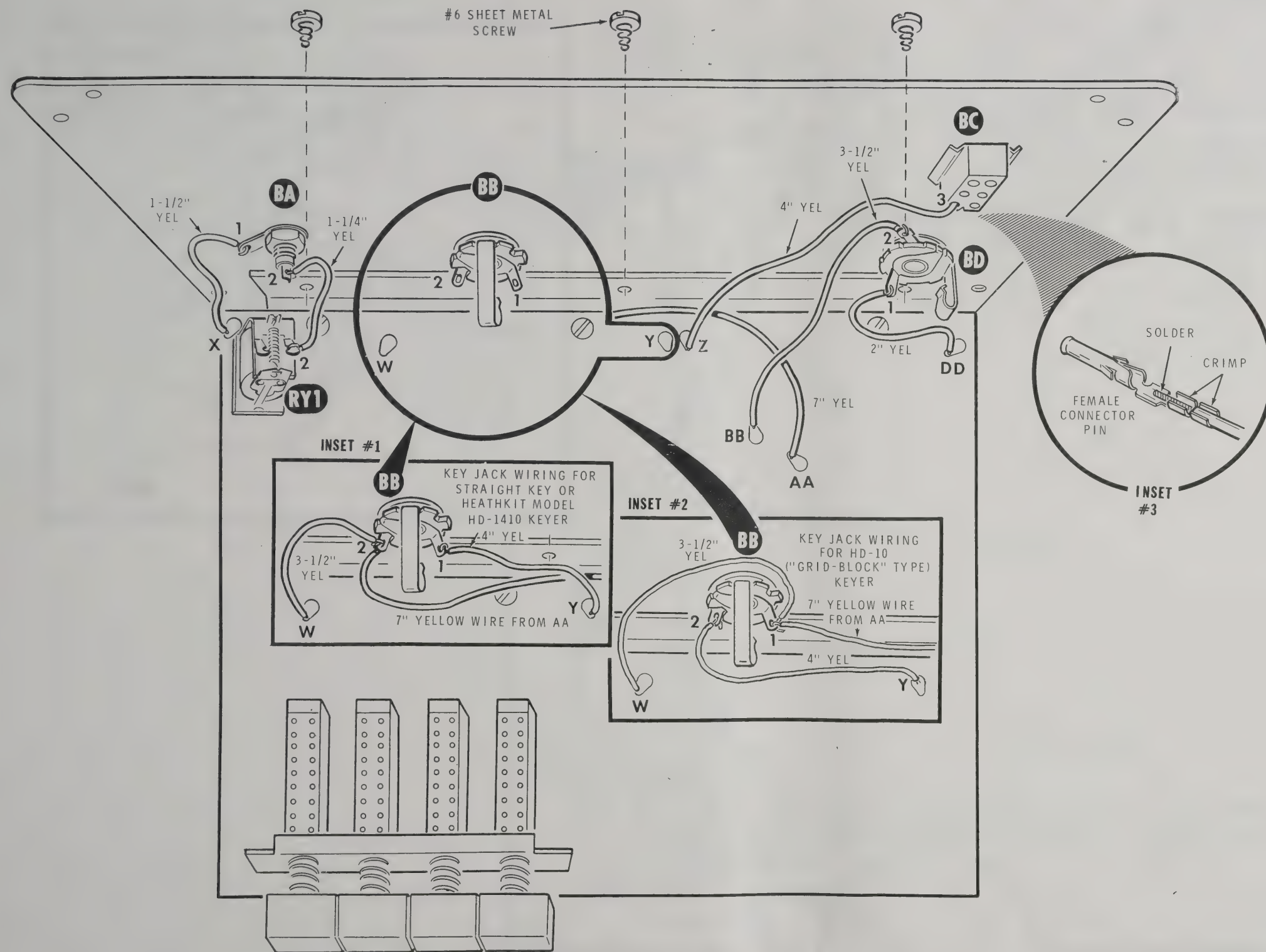
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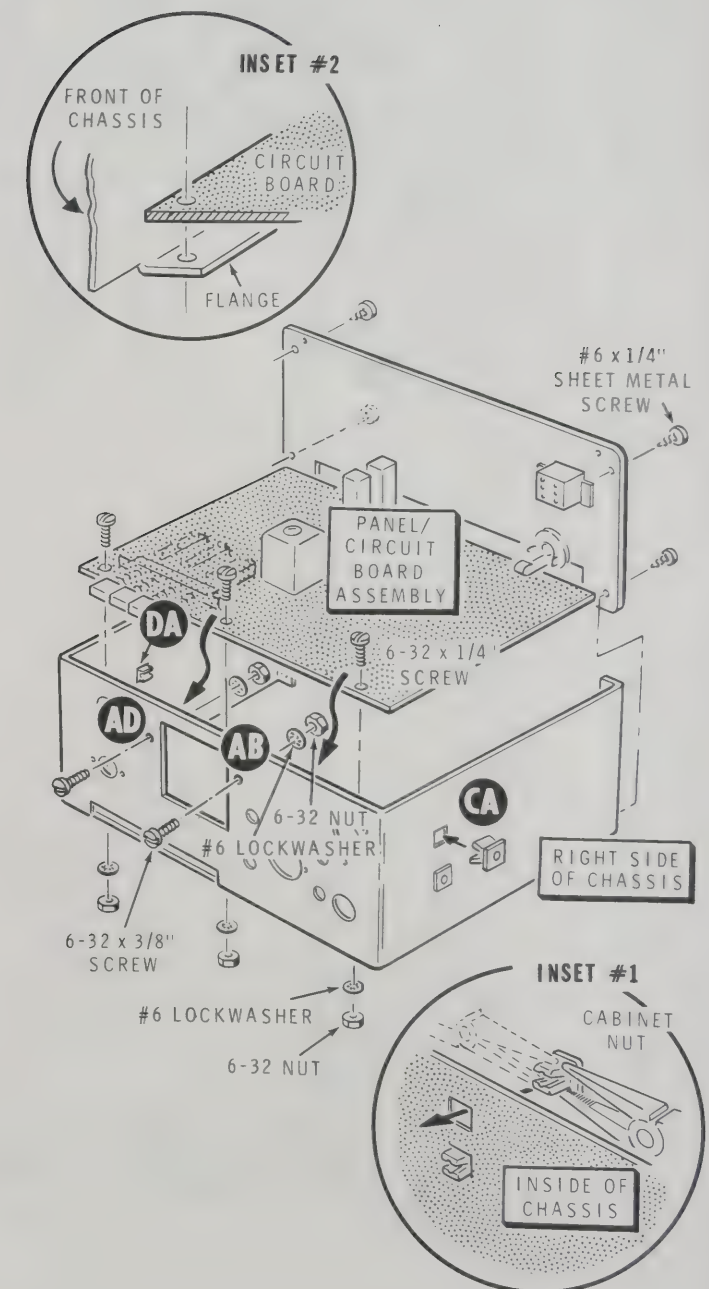
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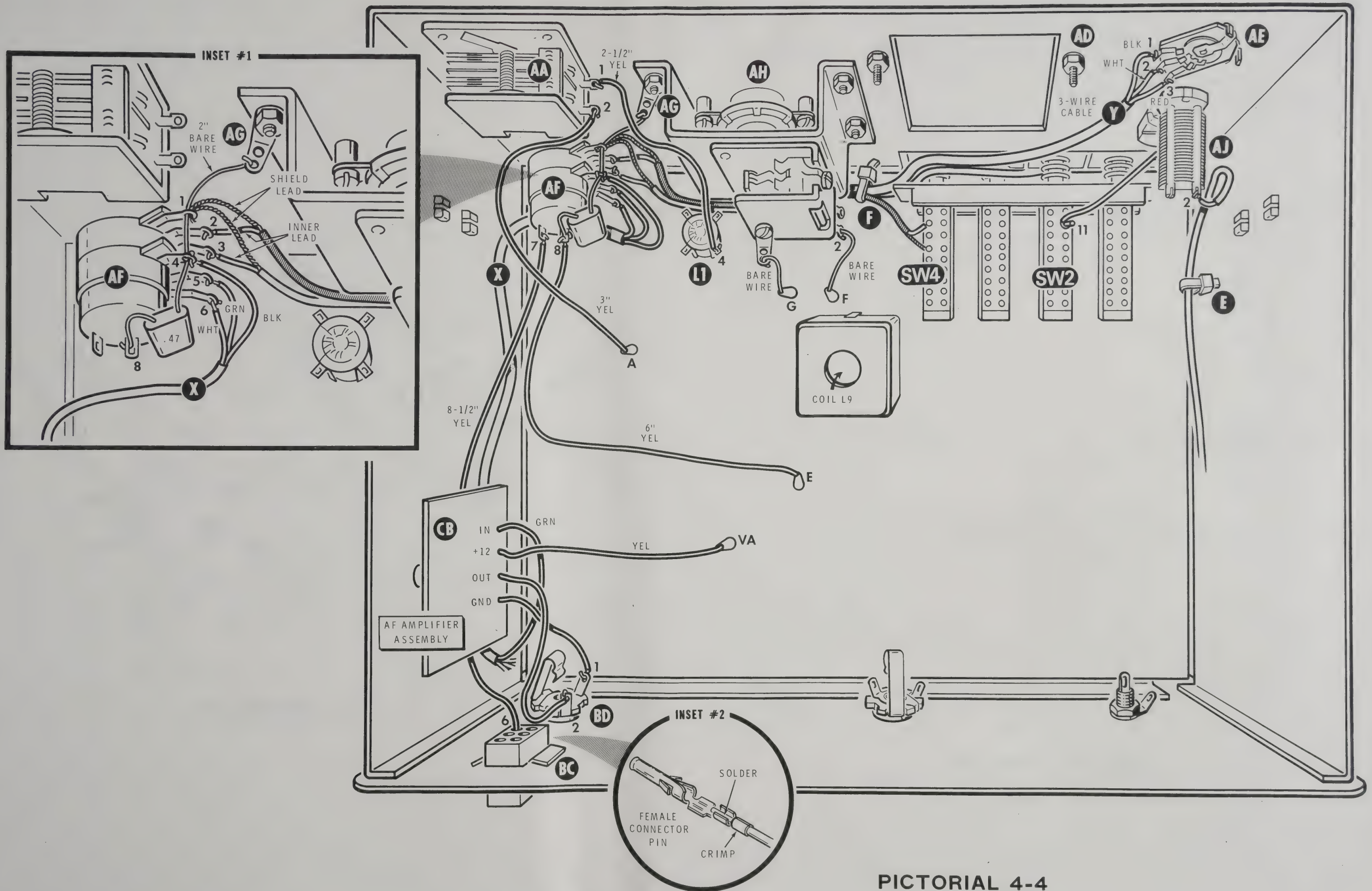
PICTORIAL 3-3



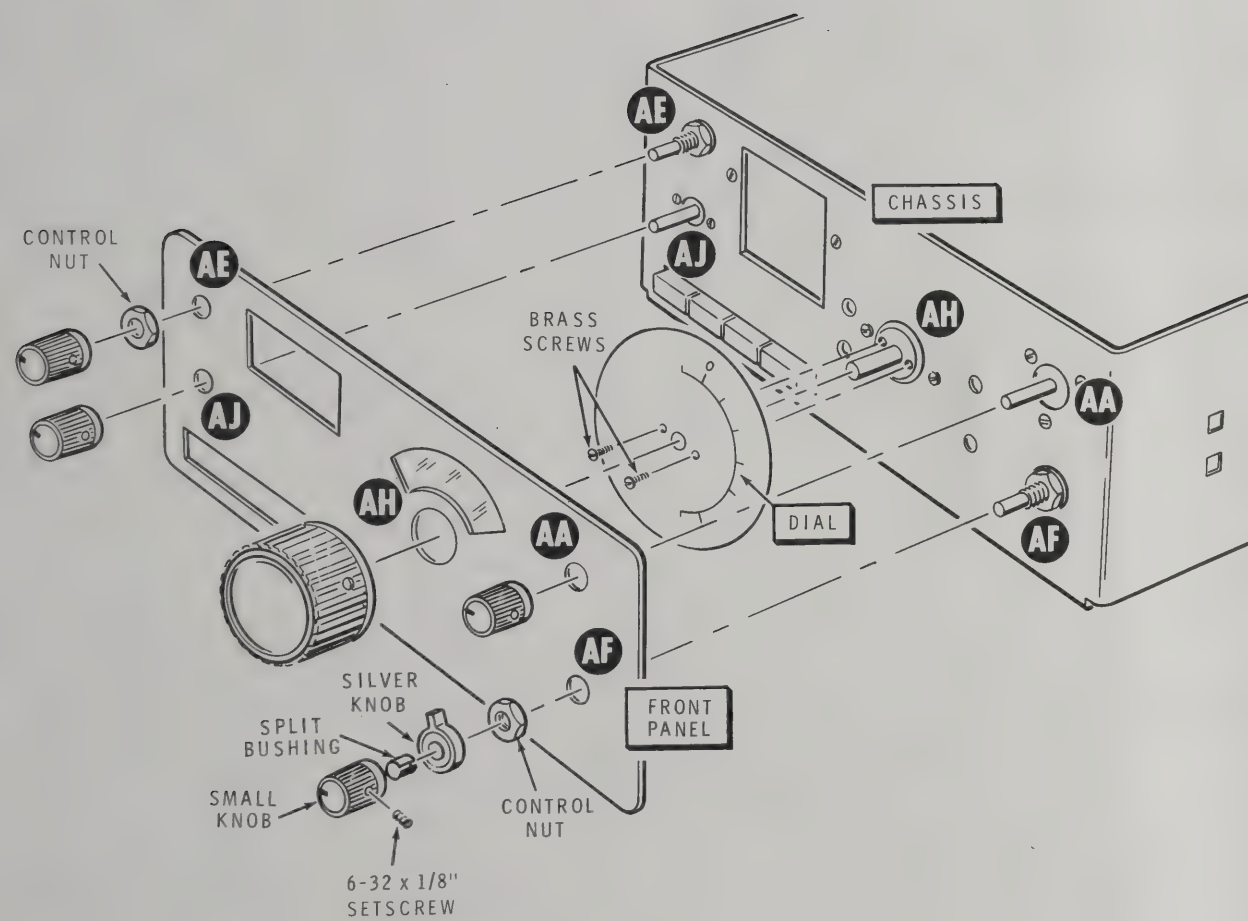
PICTORIAL 4-2



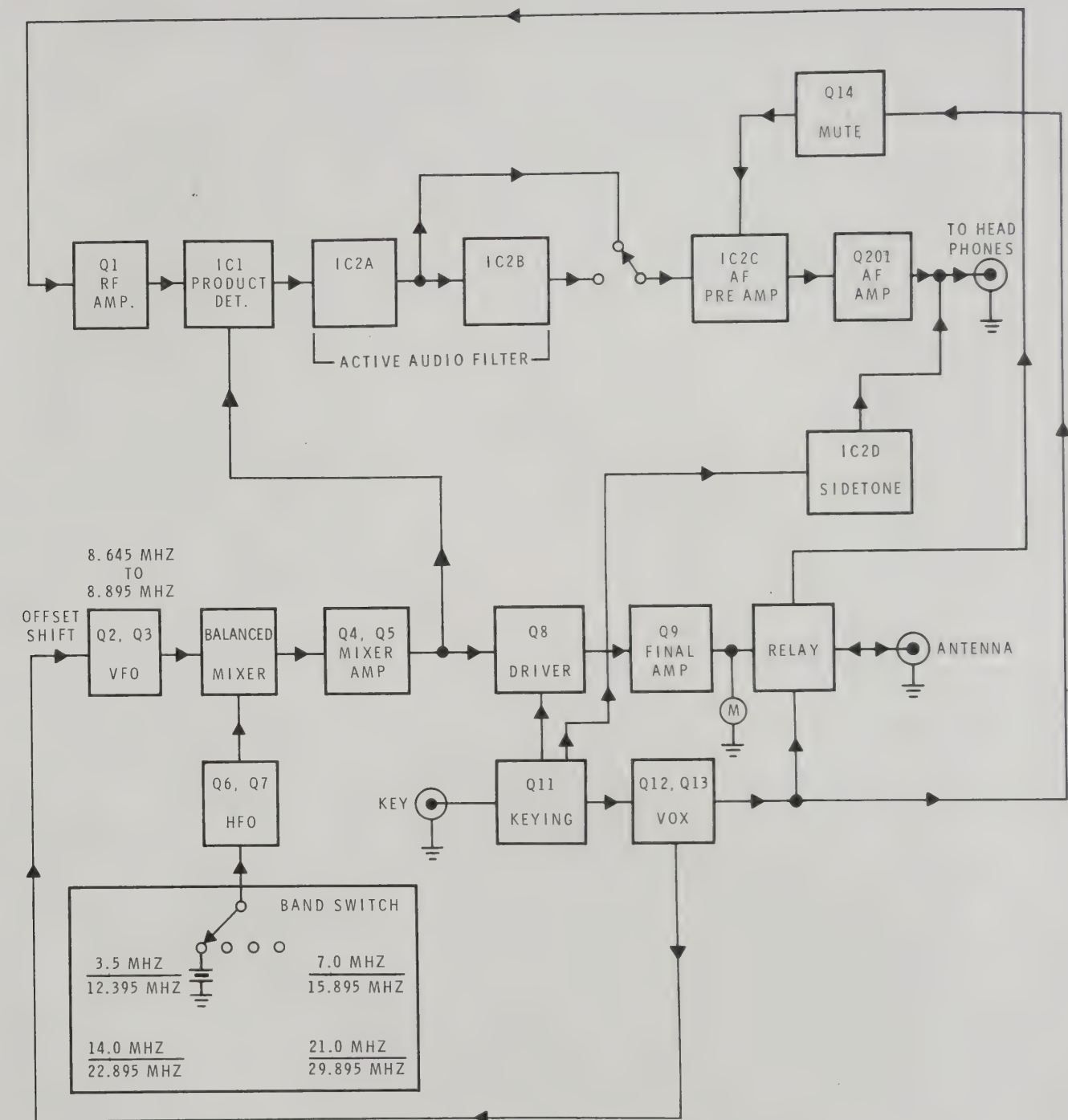
PICTORIAL 4-3



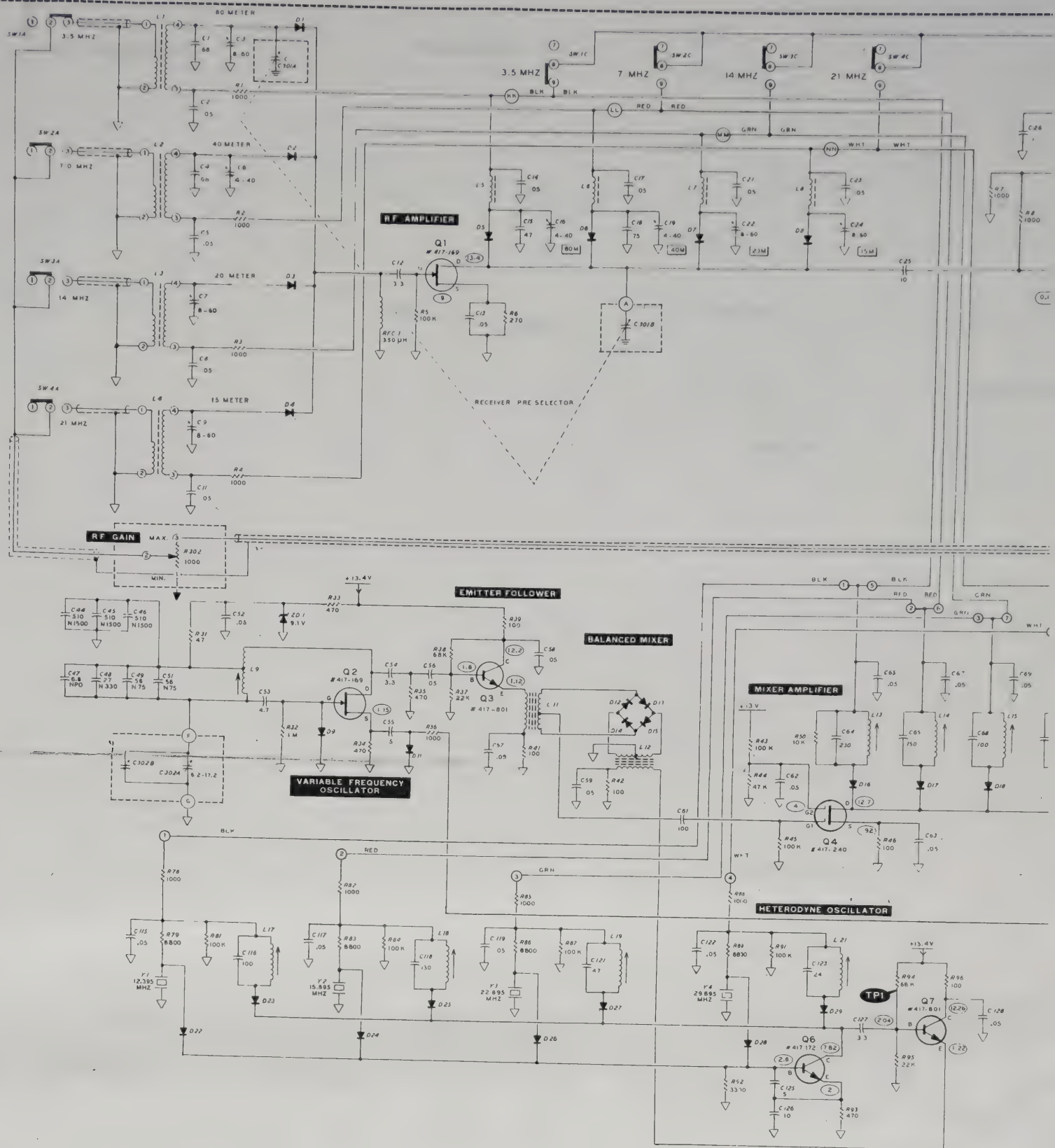
PICTORIAL 4-4



PICTORIAL 4-5



BLOCK DIAGRAM



# SCHEMATIC OF THE HEATHKIT MODEL HW-8 TRANSCIVER

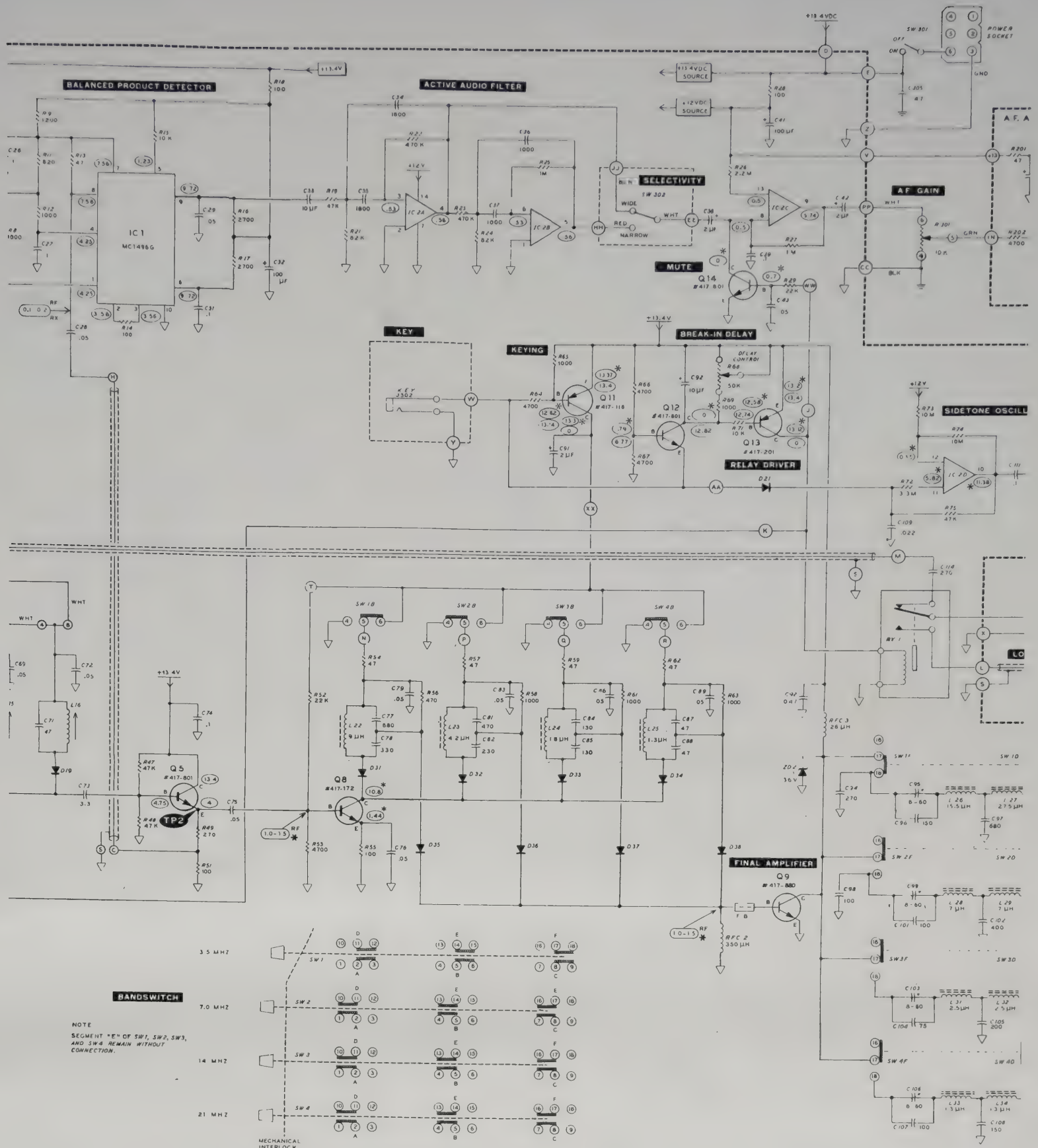
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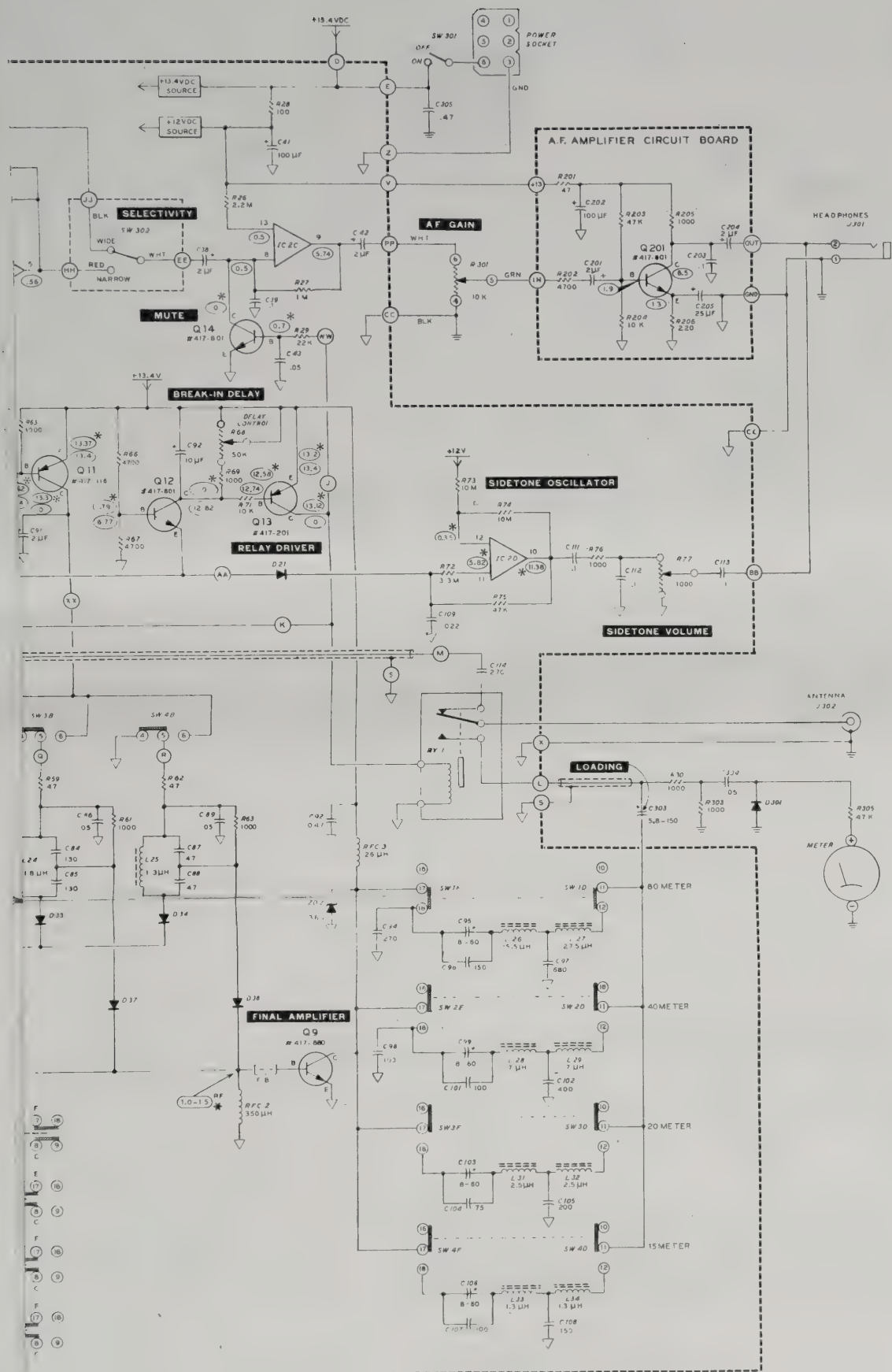
Part of I-595-1754-07

## NOTES

1. CIRCUIT COMPONENT NUMBERS ARE IN THE FOLLOWING GROUPS  
1 - 199 PARTS MOUNTED ON MAIN CIRCUIT BOARD.  
201 - 225 PARTS MOUNTED ON AF AMPLIFIER CIRCUIT BOARD  
301 - 325 PARTS MOUNTED ON CHASSIS.
2. ALL RESISTOR VALUES ARE IN OHMS (K=1,000; M=1,000,000).
3. ALL CAPACITOR VALUES LESS THAN 1 ARE IN  $\mu$ F. VALUES OF 1 AND ABOVE ARE IN pF UNLESS OTHERWISE INDICATED.
4. **TP** THIS SYMBOL INDICATES A TEST POINT.

5. THIS SYMBOL INDICATES A RECEIVE-MODE DC VOLTAGE MEASURED FROM THE POINT INDICATED TO CHASSIS.
6. THIS SYMBOL INDICATES A TRANSMIT-MODE DC VOLTAGE MEASURED FROM THE POINT INDICATED TO CHASSIS.
7. THIS SYMBOL INDICATES A RECEIVE-MODE RF VOLTAGE MEASURED USING AN RF PROBE CONNECTED BETWEEN THE POINT INDICATED AND CHASSIS.
8. THIS SYMBOL INDICATES A TRANSMIT-MODE RF VOLTAGE MEASURED USING AN RF PROBE CONNECTED BETWEEN THE POINT INDICATED AND CHASSIS.
9. ALL VOLTAGES MEASURED WITH A HIGH INPUT IMPEDANCE VOLTMETER. VOLTAGES MAY VARY  $\pm 20\%$ .
10. ALL MEASUREMENTS OBTAINED USING A POWER SOURCE OF 13 VDC.
11. BANDSWITCH SHOWN WITH 3.5 MHz PUSHBUTTON PRESSED IN AND TRANSCIVER OPERATING IN RECEIVE MODE.





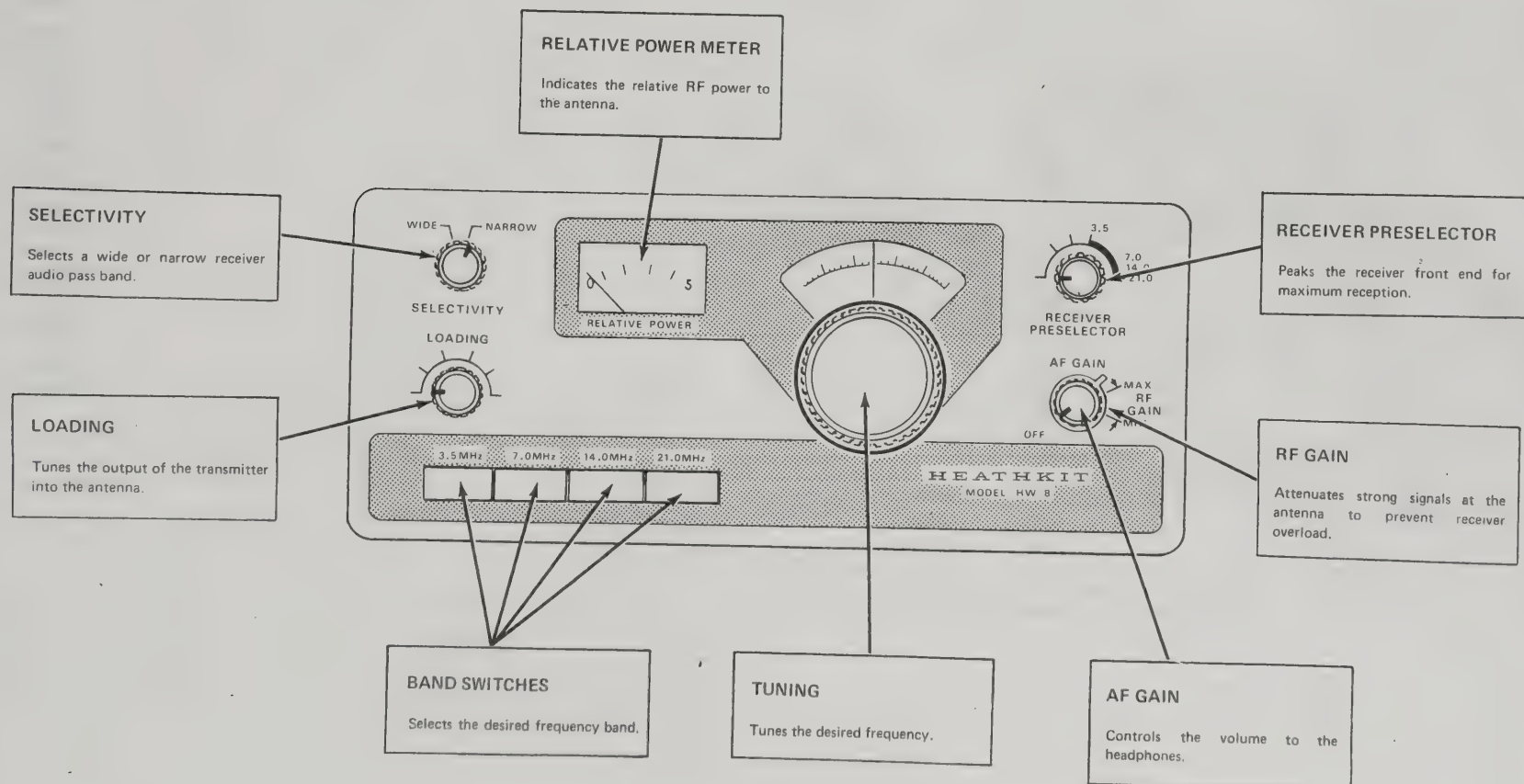
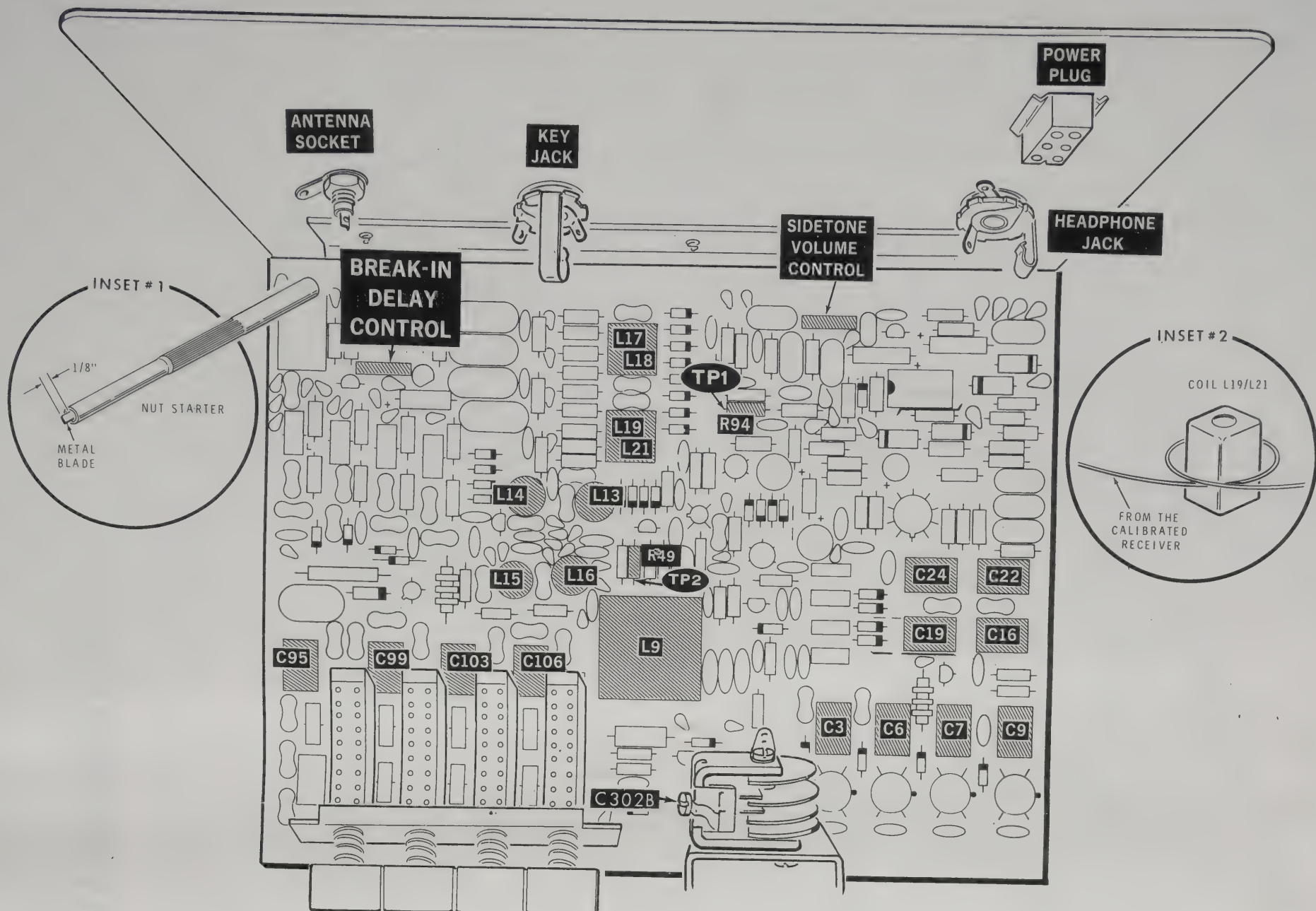
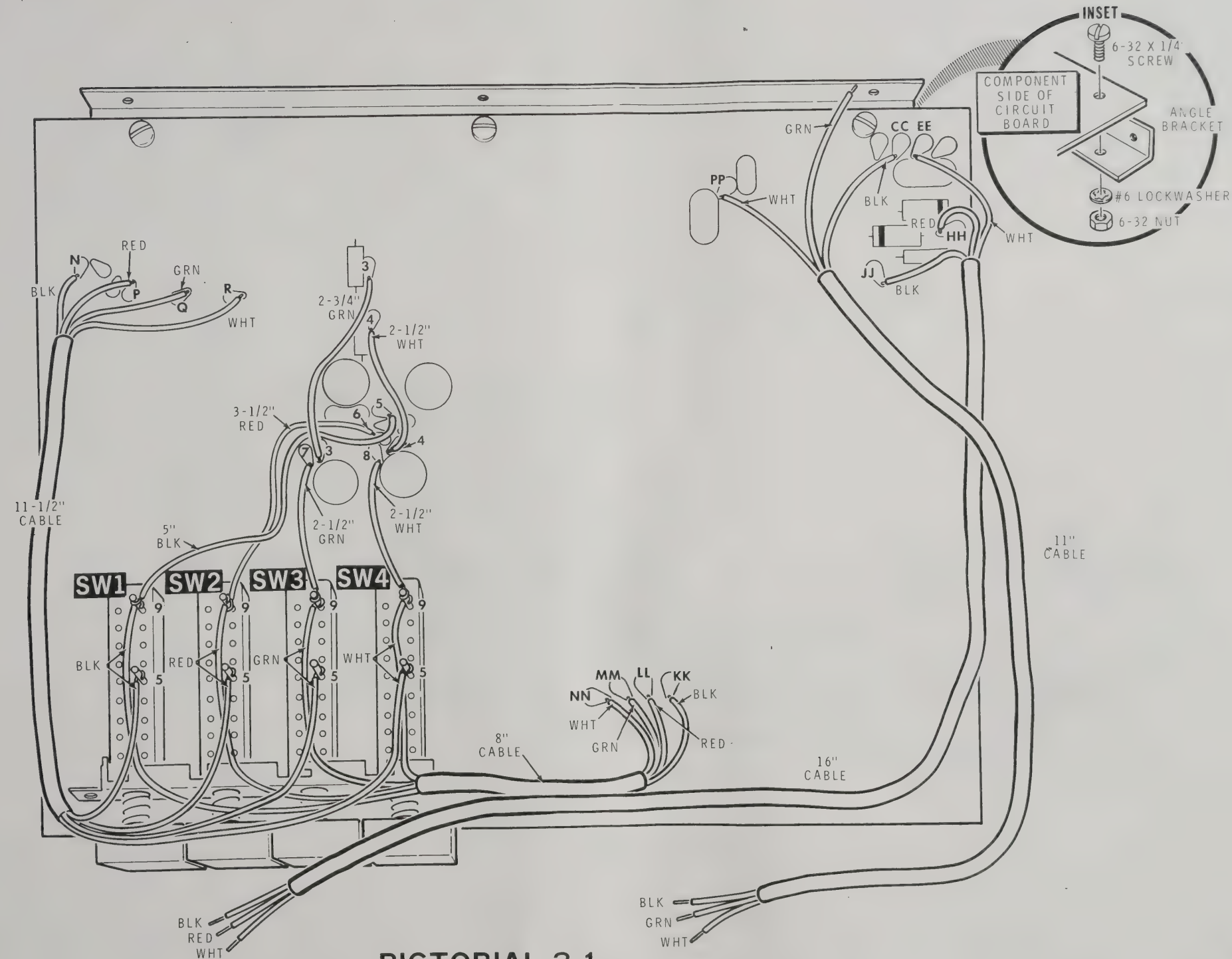


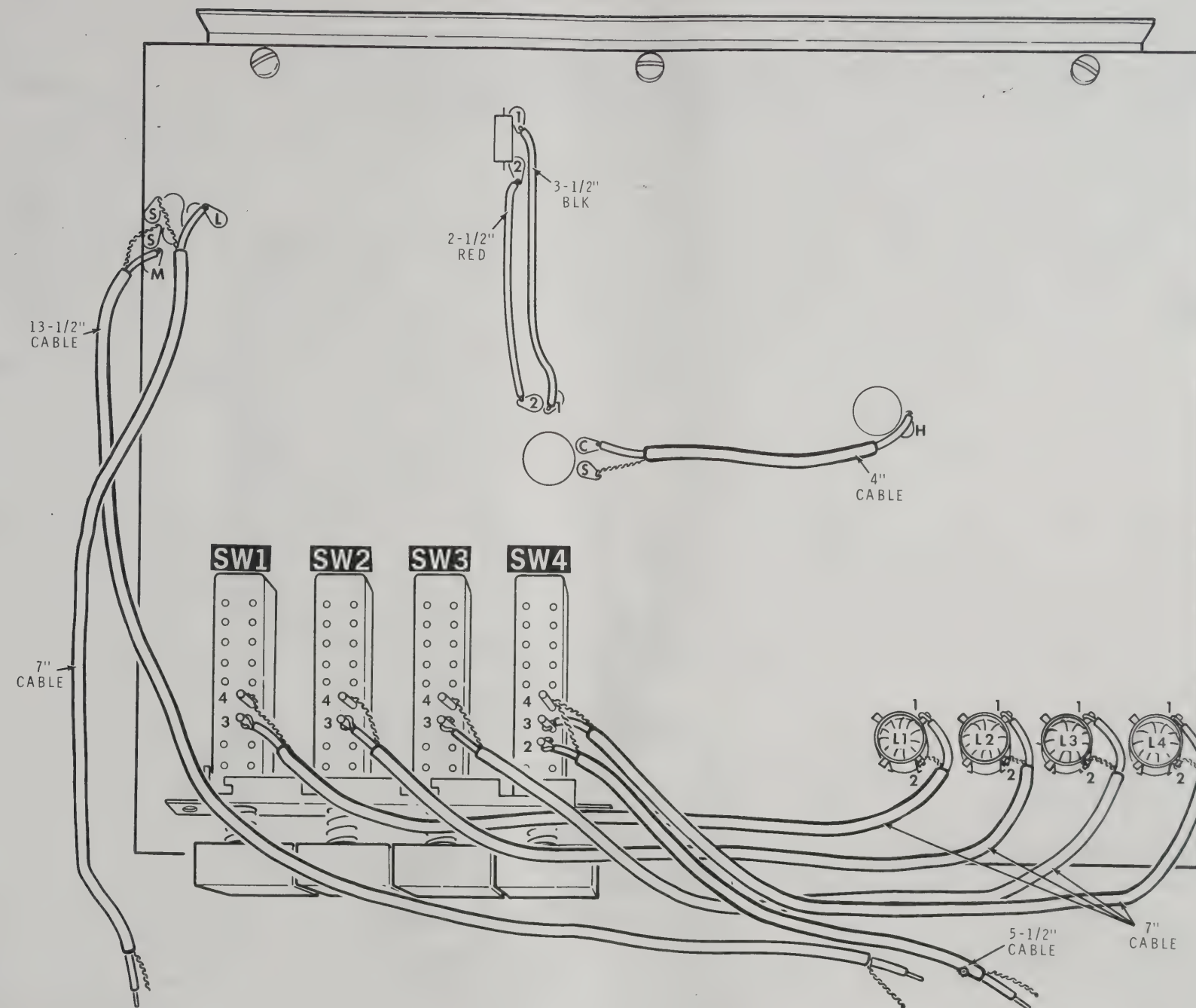
Figure 1-2

# ILLUSTRATION BOOKLET

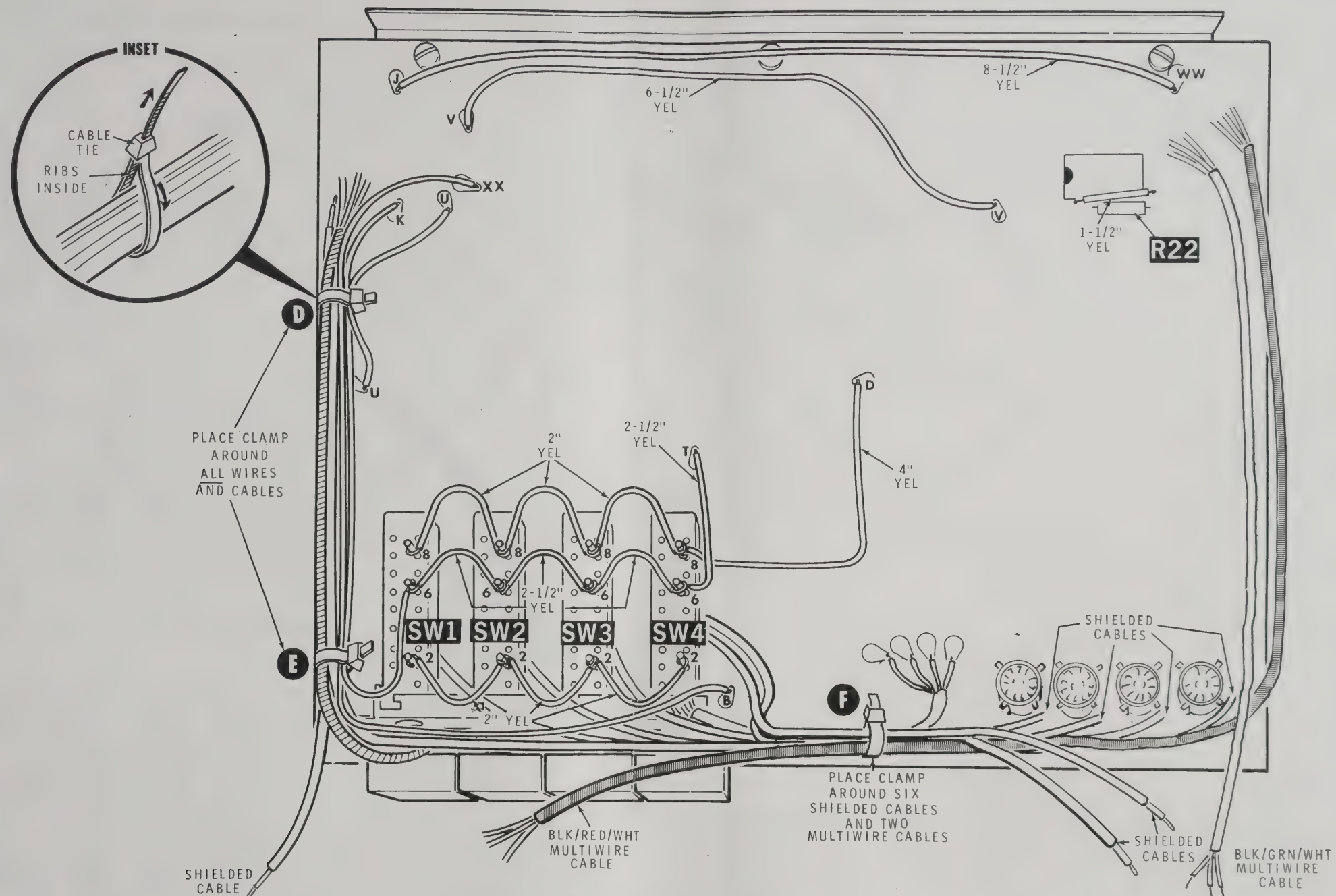
Part of I-595-1754-07



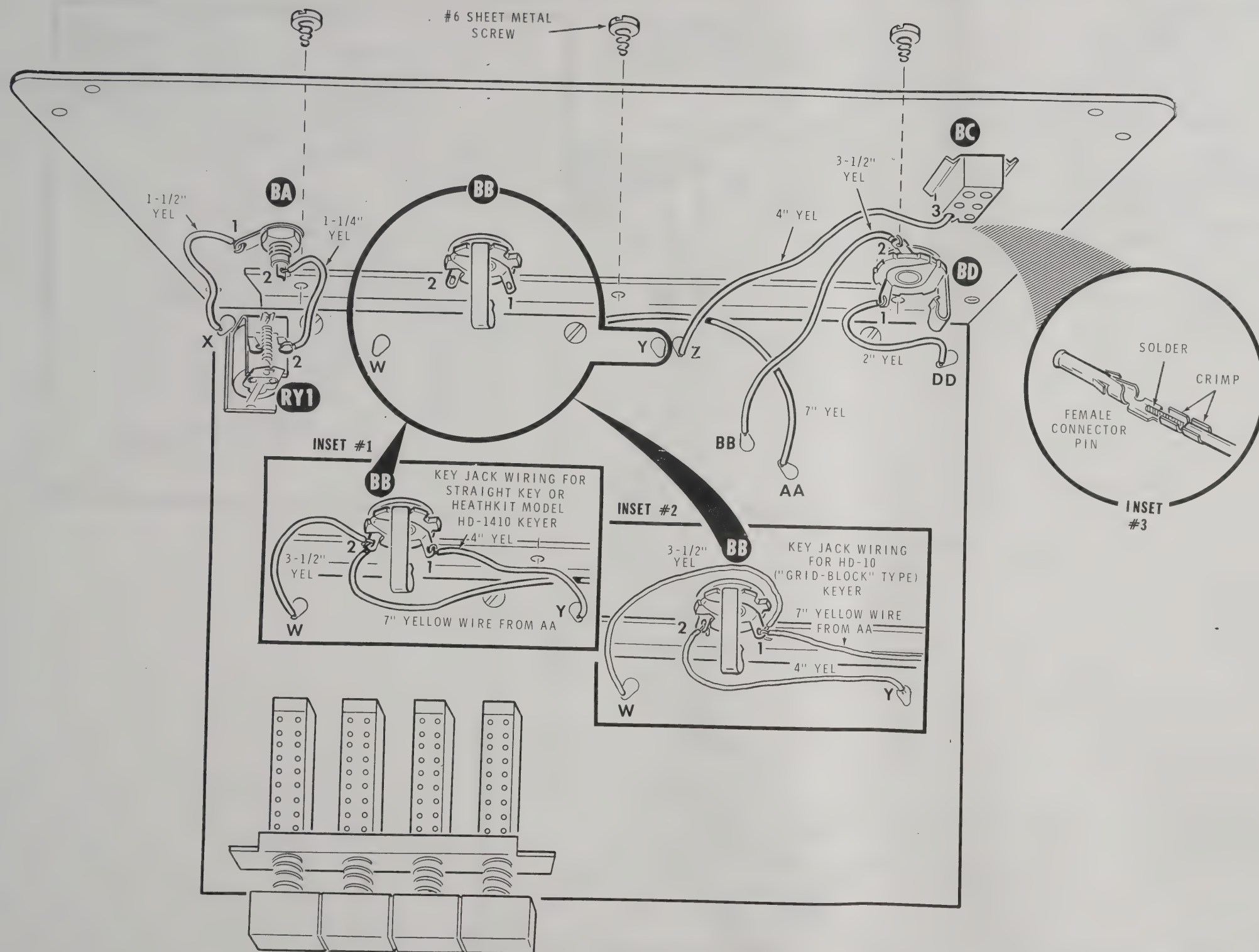
PICTORIAL 3-1



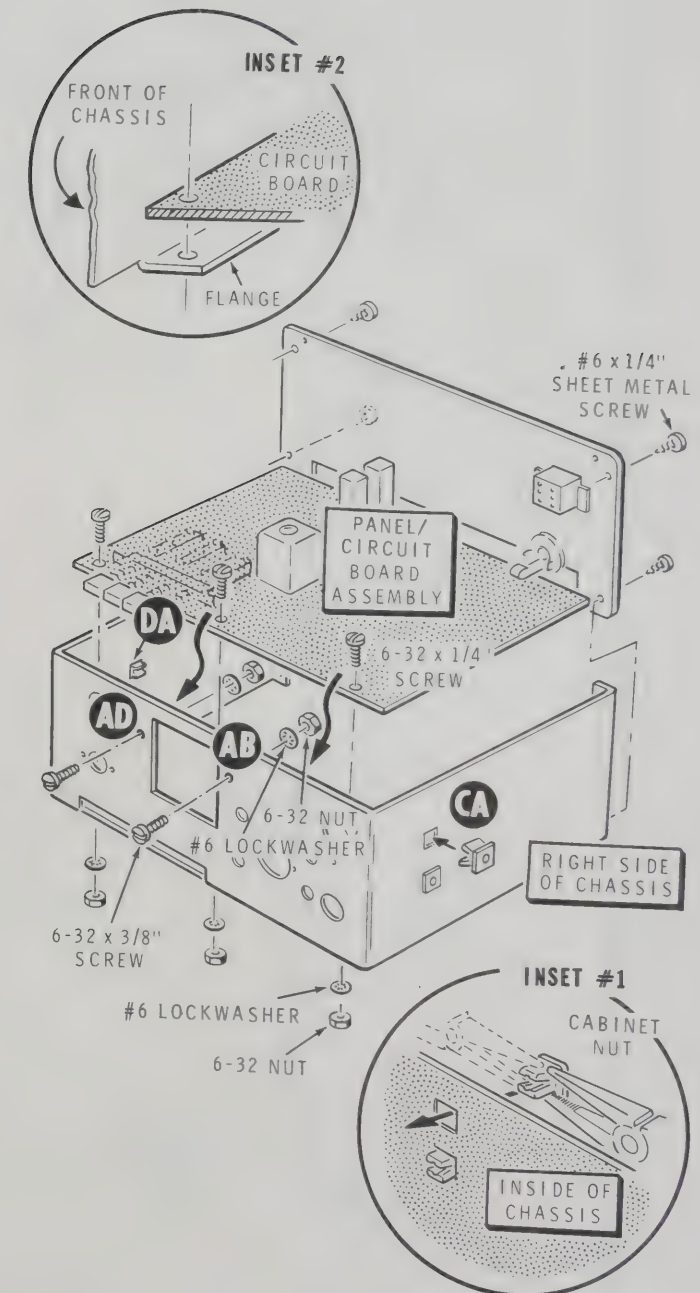
PICTORIAL 3-2



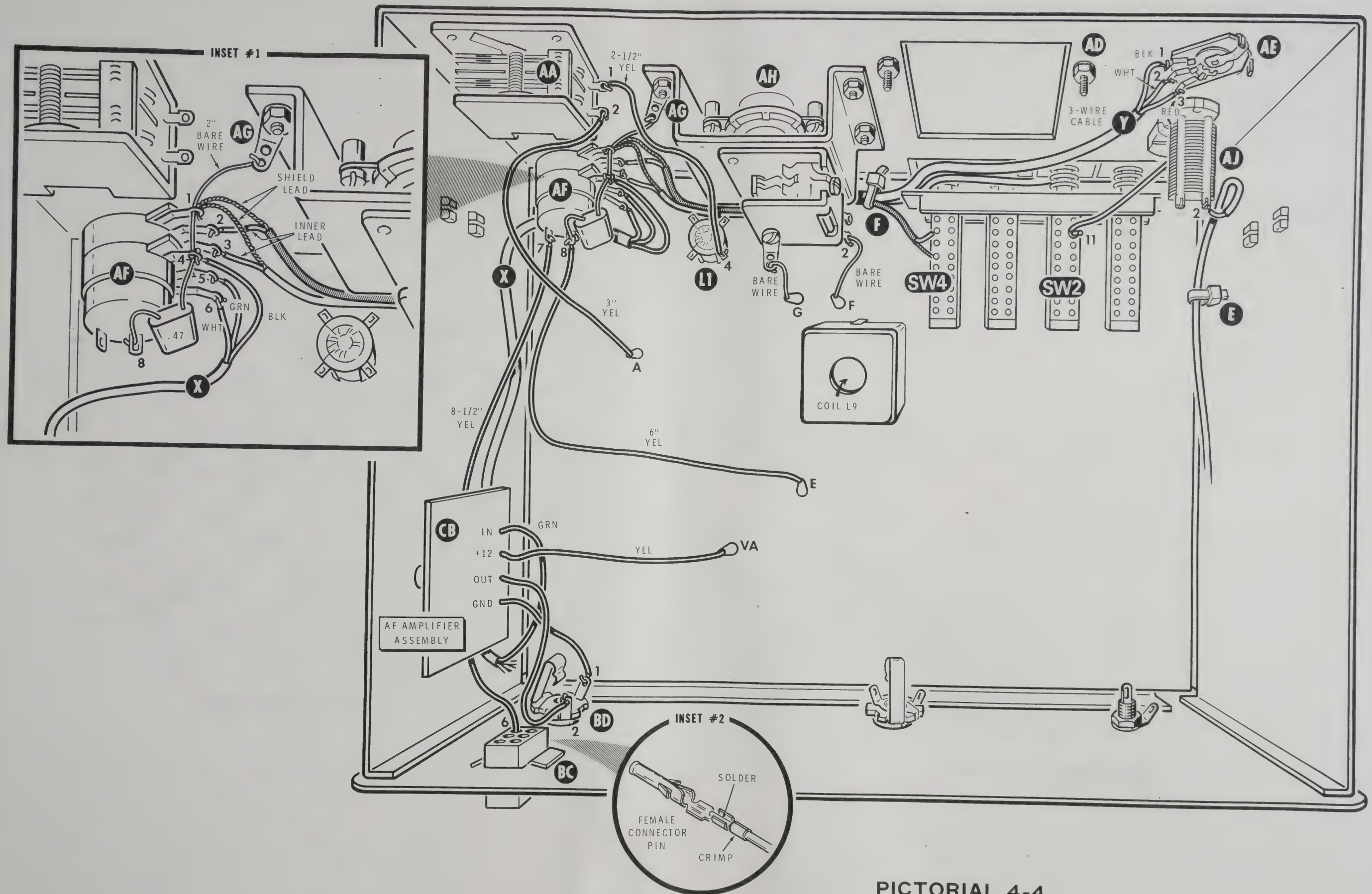
**PICTORIAL 3-3**

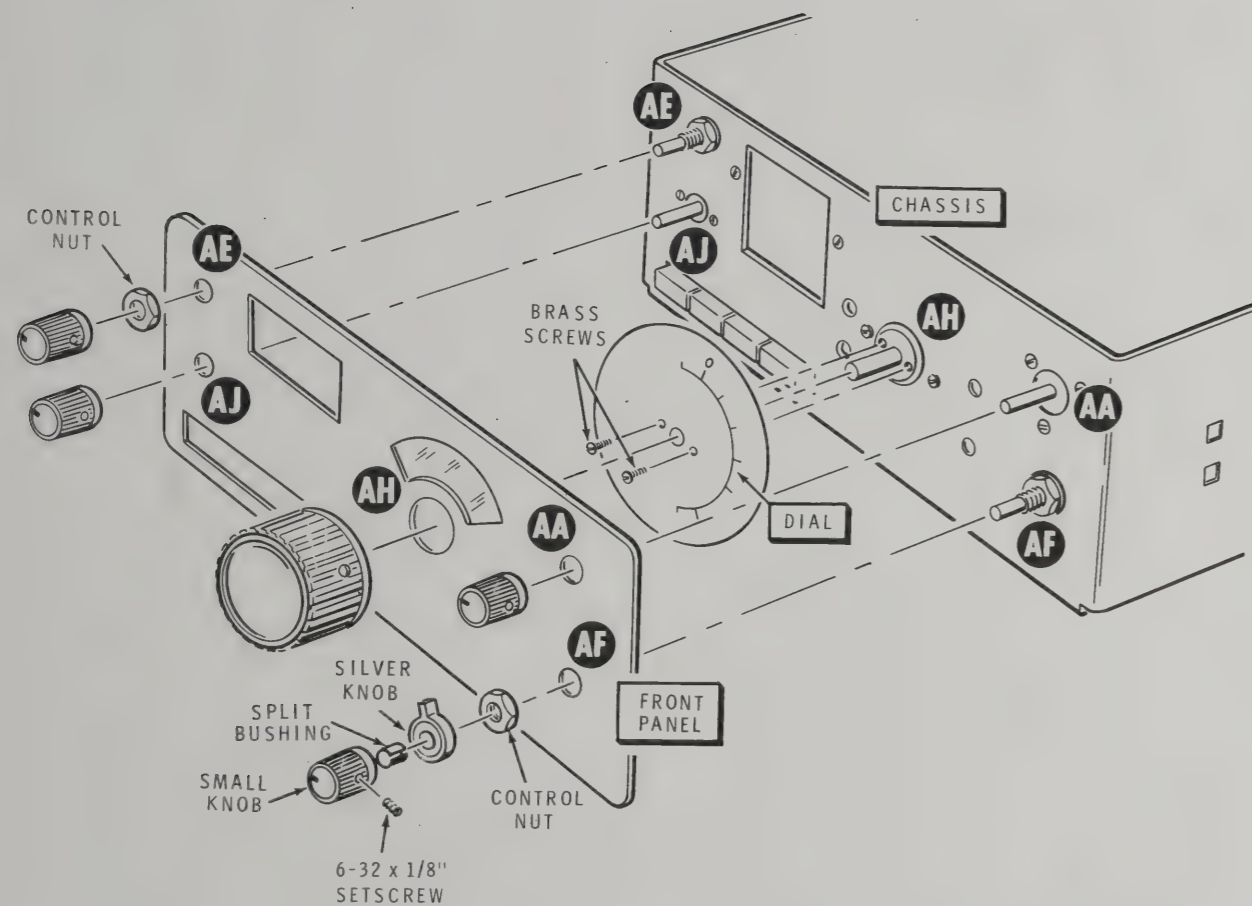


PICTORIAL 4-2

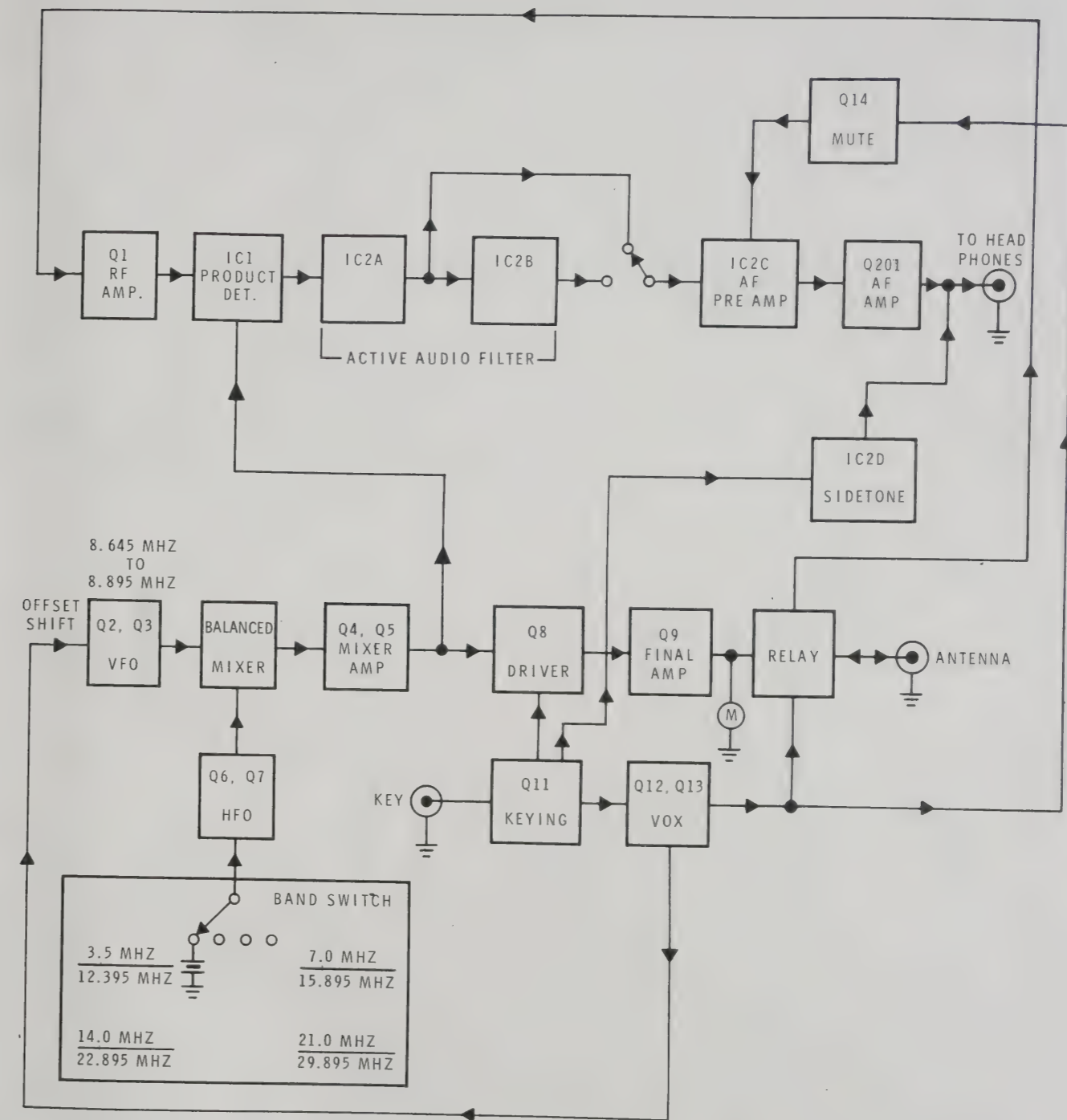


PICTORIAL 4-3

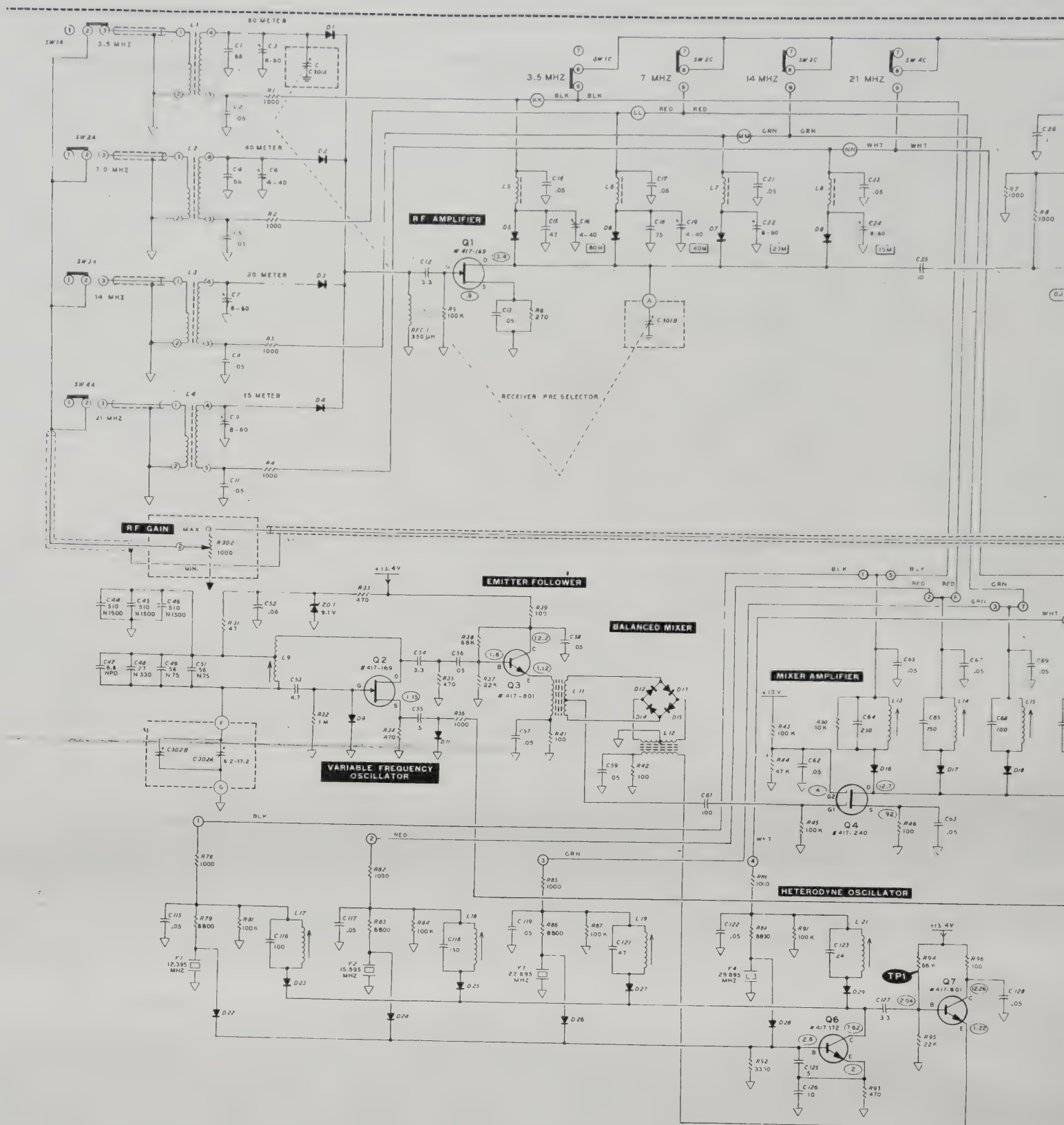




PICTORIAL 4-5



BLOCK DIAGRAM



**SCHEMATIC OF THE  
HEATHKIT  
MODEL HW-8  
TRANSCIVER**

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Part of I-595-1754-07

**NOTES**

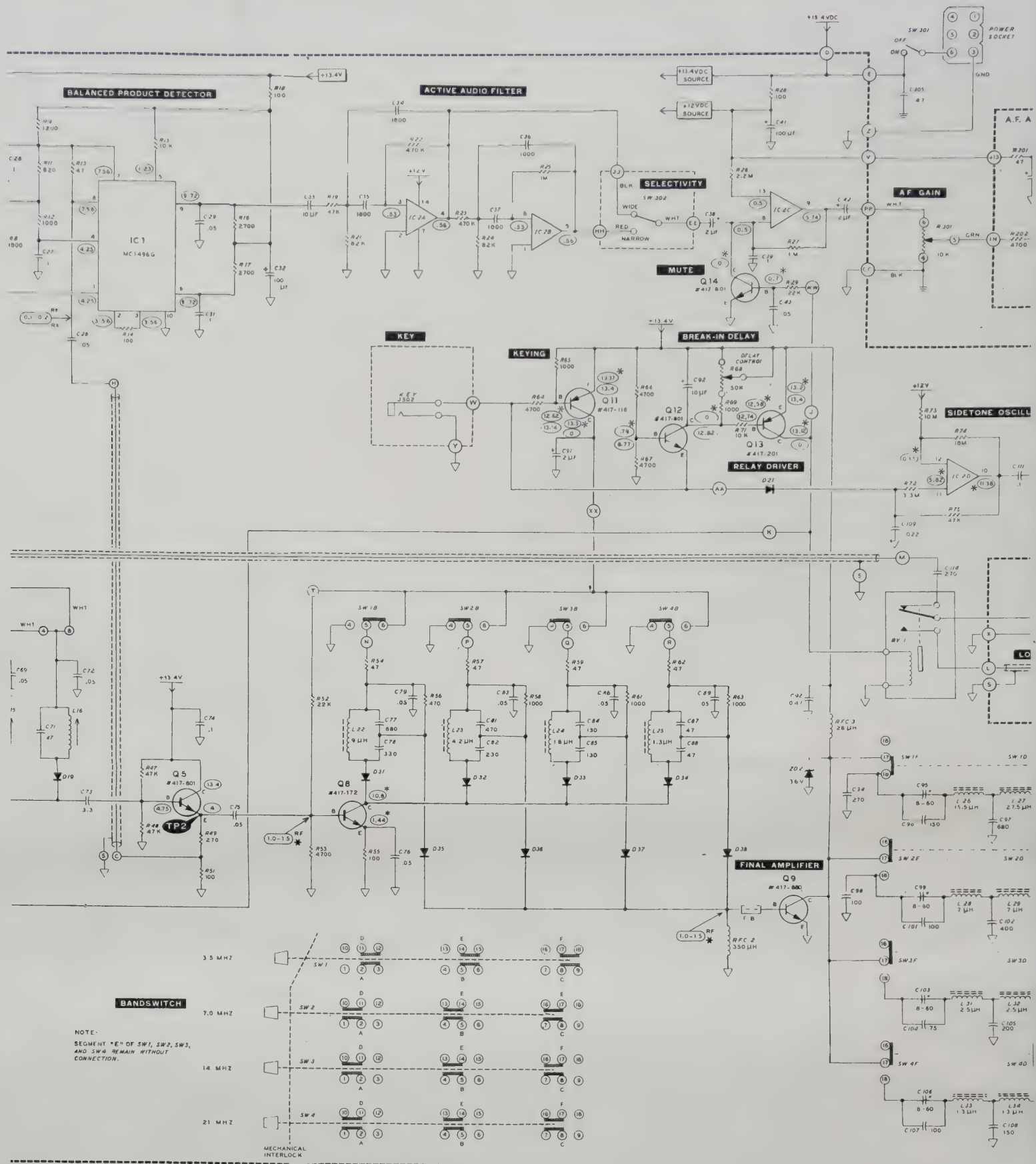
1. CIRCUIT COMPONENT NUMBERS ARE IN THE FOLLOWING GROUPS:  
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201 - 225 PARTS MOUNTED ON RF AMPLIFIER CIRCUIT BOARD.  
301 - 325 PARTS MOUNTED ON CHASSIS.

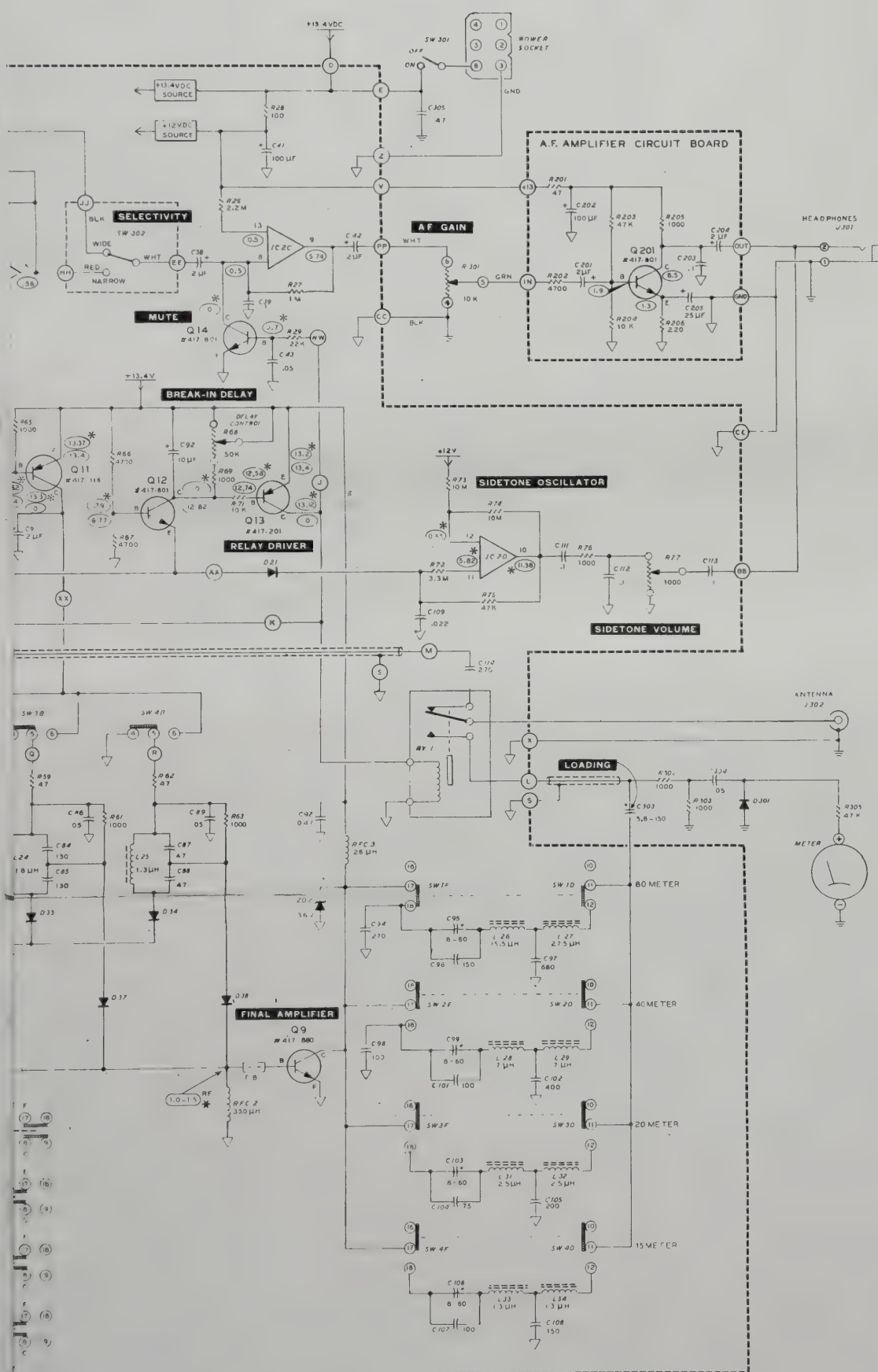
2. ALL RESISTOR VALUES ARE IN OHMS (K=1,000; M=1,000,000).

3. ALL CAPACITOR VALUES LESS THAN 1 ARE IN  $\mu$ F. VALUES OF 1 AND ABOVE ARE IN pF UNLESS OTHERWISE INDICATED.

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10. ALL MEASUREMENTS OBTAINED USING A POWER SOURCE OF 13 VDC.
11. BANDSWITCH SHOWN WITH 3.5 MHz PUSHBUTTON PRESSED IN AND TRANSCIVER OPERATING IN RECEIVE MODE.







ORIG

(all)

MOSTLY  
BACIL + front

Check  
Diagram



# HEATHKIT<sup>®</sup> MANUAL

*for the*

## LOW-POWER CW TRANSCEIVER

Model HW-8

I-595-1754-07



HEATH COMPANY • BENTON HARBOR, MICHIGAN

## HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

- Kit orders and delivery information ..... (616) 982-3411  
Credit ..... (616) 982-3561  
Replacement Parts ..... (616) 982-3571

### *Technical Assistance Phone Numbers*

8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only  
R/C, Audio, and Electronic Organs ..... (616) 982-3310  
Amateur Radio ..... (616) 982-3296  
Test Equipment, Weather Instruments and  
Home Clocks ..... (616) 982-3315  
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If you are not satisfied with our service - warranty or otherwise - or with our products, write directly to our Director of Customer Services, Heath Company, Benton Harbor, Michigan 49022. He will make certain your problems receive immediate, personal attention.

Our attorney, who happens to be quite a kitbuilder himself, insists that we describe our warranty using all the necessary legal phrases in order to comply with the new warranty regulations. Fine. Here they are:

For a period of ninety (90) days after purchase, Heath Company will replace or repair free of charge any parts that are defective either in materials or workmanship. You can obtain parts directly from Heath Company by writing us at the address below or by telephoning us at (616) 982-3571. And we'll pay shipping charges to get those parts to you — anywhere in the world.

We warrant that during the first ninety (90) days after purchase, our products, when correctly assembled, calibrated, adjusted and used in accordance with our printed instructions, will meet published specifications.

If a defective part or error in design has caused your Heathkit product to malfunction during the warranty period through no fault of yours, we will service it free upon proof of purchase and delivery at your expense to the Heath factory, any Heathkit Electronic Center (units of Schlumberger Products Corporation), or any of our authorized overseas distributors.

You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

Our warranty does not cover and we are not responsible for damage caused by the use of corrosive solder, defective tools, incorrect assembly, misuse, fire, or by unauthorized modifications to or uses of our products for purposes other than as advertised. Our warranty does not include reimbursement for customer assembly or set-up time.

This warranty covers only Heathkit products and is not extended to allied equipment or components used in conjunction with our products. **We are not responsible for incidental or consequential damages.** Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

HEATH COMPANY  
BENTON HARBOR, MI. 49022

Prices and specifications subject to change without notice.

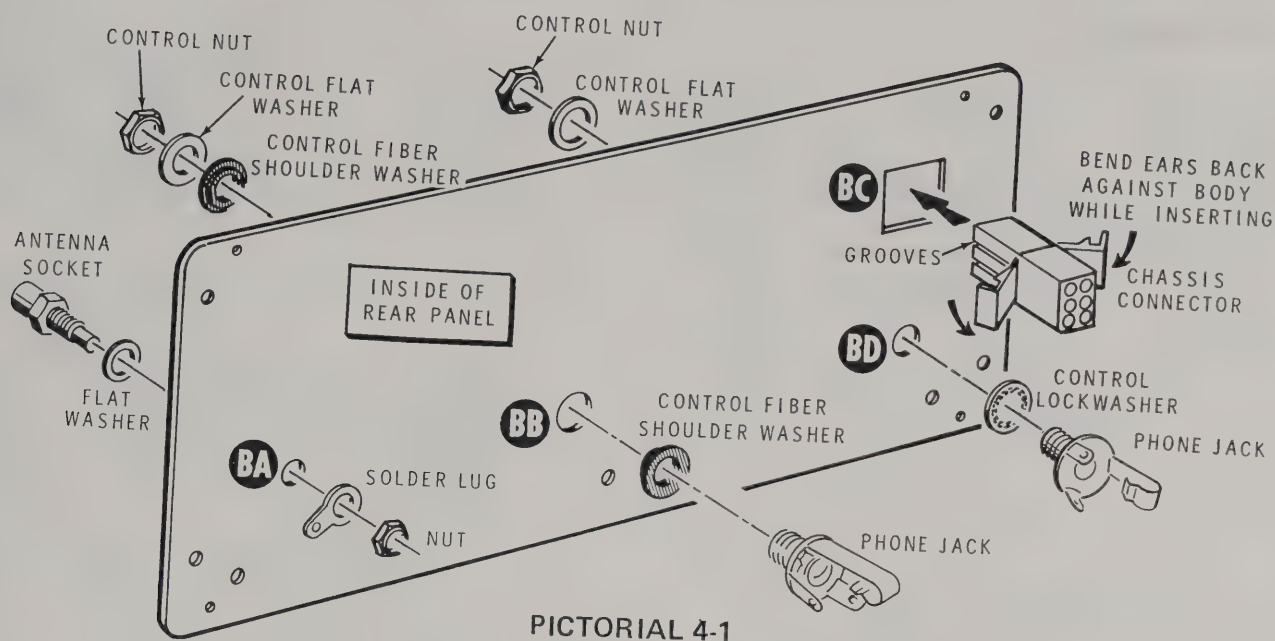


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## STEP-BY-STEP ASSEMBLY



PICTORIAL 4-1

### REAR PANEL PARTS MOUNTING

Refer to Pictorial 4-1 for the following steps.

- (✓) Install an antenna socket in hole BA with the hardware supplied with the socket. Position the lug as shown; then bend it away from the panel. **CAUTION:** Do not overtighten the hardware, as you could break the socket.
- (✓) Install a phone jack in hole BB with two fiber shoulder washers, a control flat washer, and a control nut. Position the jack as shown in the Pictorial. **CAUTION:** Be sure the shoulders of the fiber washers are properly seated in the panel before you tighten the hardware.
- (✓) Install a phone jack in hole BD with a control lockwasher, control flat washer, and control nut. Position the jack as shown in the Pictorial. Also, note the difference in position between this jack and jack BB.
- (✓) Install the chassis connector in hole BC. **CAUTION:** Be sure you install it so its grooves are positioned as shown in the Pictorial.

### MOUNTING AND WIRING REAR PANEL

Refer to Pictorial 4-2 in the Illustration Booklet for the following steps.

- (✓) Mount the rear panel assembly to the angle bracket on the circuit board with #6 x 1/4" sheet metal screws at the three indicated locations.

- (✓) Prepare the following yellow wires:

1-1/2"	4"
1-1/4"	4"
3-1/2"	3-1/2"
7"	2"

Connect wires from the circuit board to the parts on the rear panel as follows:

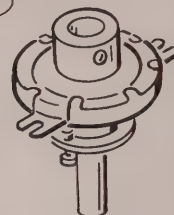
- (✓) 1-1/2" yellow wire from hole X (S-1) to socket BA lug 1 (S-1).
- (✓) 1-1/4" yellow wire from relay RY1 lug 2 (S-1) to socket BA lug 2 (S-1).

KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

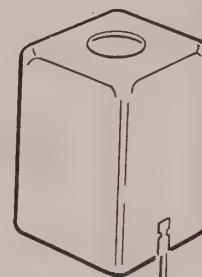
# MISCELLANEOUS

H11	(1)	1	Vernier drive	100-1608
H12	(1)	1	Coil shield	206-502
H13	(1)	1	Meter	407-167
H14	(1)	1	3-lug terminal strip	431-10
H15	(4)	4	Plastic chassis nut	75-61
H16	(1)	1	Alignment tool, small	490-109
H17	(1)	1	Alignment tool, large	490-1
H18	(1)	1	Metal blade	205-778
H19	(4)	4	Plastic foot	261-34
	(5')	5'	Red wire	344-3
	(5')	5'	Black wire	344-2

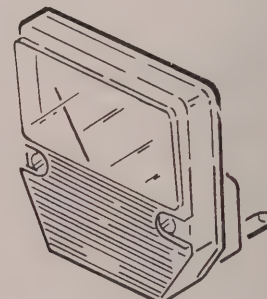
H11



H12



H13



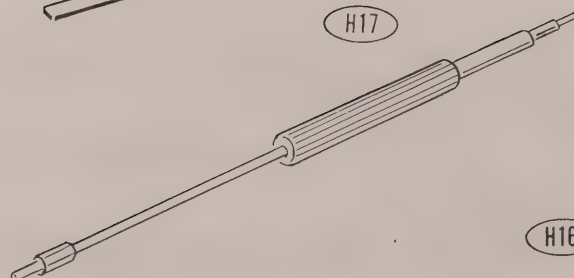
H14



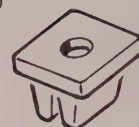
H18



H17



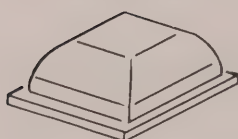
H15



H16



H19



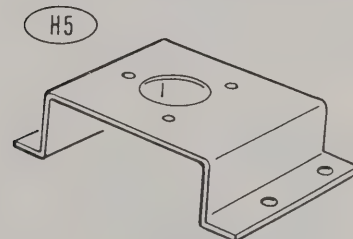
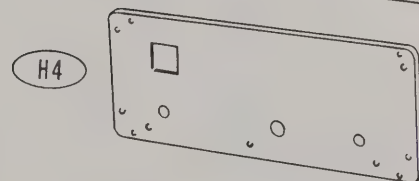
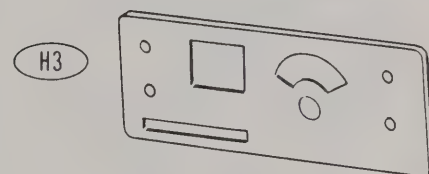
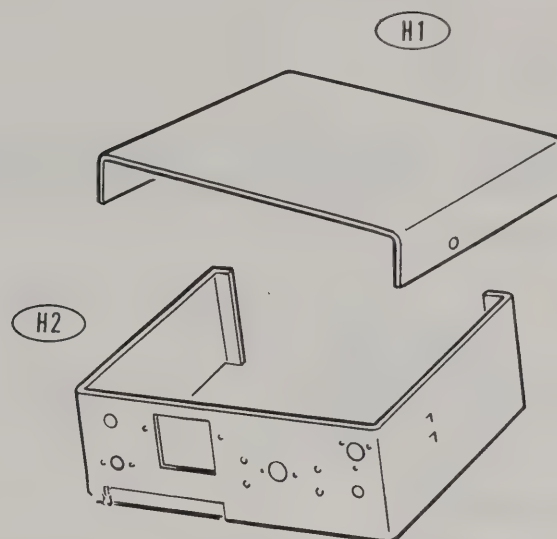
KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

# METAL PARTS

H1	(✓)	2	Cabinet shell	90-566-2
H2	(✓)	1	Chassis	200-1229
H3	(✓)	1	Front panel	203-1665-1
H4	(✓)	1	Rear panel	203-1710-2
H5	(✓)	1	Capacitor mounting bracket	204-1845

# KNOBS-DIAL-WINDOW

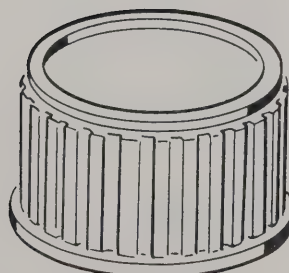
H6	(✓)	1	Large knob	462-257
H7	(✓)	4	Small knob	462-258
H8	(✓)	1	Silver knob	462-293
H9	(✓)	1	Dial	464-65-2
H10	(+)	1	Window	446-602-1



H7



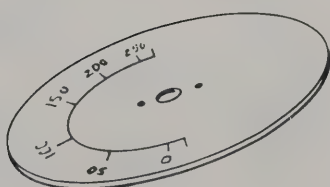
H6



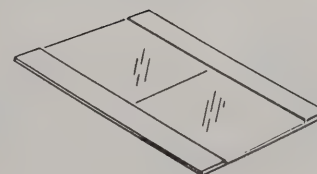
H8



H9



H10



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

## HARDWARE

NOTE: The hardware may be in more than one packet. Open all the hardware packets before you check the hardware against the Parts List.

### #4 Hardware

G1 ( )	2	4-40 x 1/4" screw	250-52
G2 ( )	2	4-40 x 1/2" flat head screw	250-322
G3 ( )	2	4-40 nut	252-15
G4 ( )	4	#4 lockwasher	254-9

### #6 Hardware

G5 ( )	1	6-32 x 1/8" round head screw	250-208
G6 ( )	4	6-32 x 1/8" setscrew	250-33
G7 ( )	6	6-32 x 3/16" screw	250-138
G8 ( )	4	6-32 x 1/4" screw	250-56
G9 ( )	4	6-32 x 1/4" flat head screw	250-416
G10 ( )	2	6-32 x 3/8" screw	250-89
G11 ( )	15	#6 x 1/4" sheet metal screw	250-170
G12 ( )	11	6-32 nut	252-3
G13 ( )	16	#6 lockwasher	254-1
G14 ( )	2	3/16" spacer	255-2
G15 ( )	4	#6 solder lug	259-1

### Other Hardware

G16 ( )	6	Control nut	252-7
G17 ( )	4	Control flat washer	253-10
G18 ( )	2	Fiber shoulder washer	253-16
G19 ( )	3	Control lockwasher	254-5
G20 ( )	1	Split bushing	455-11
G21 ( )	1	8-32 x 3/8" setscrew	250-1193

G1



G2



G3



G4



G5



G6



G7



G8



G9



G10



G11



G12



G13



G14



G15



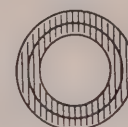
G16



G17



G18



G19



G20



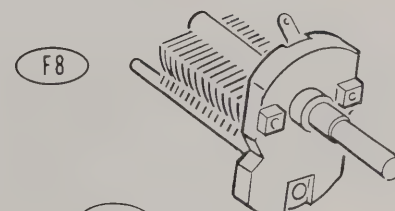
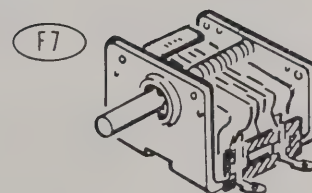
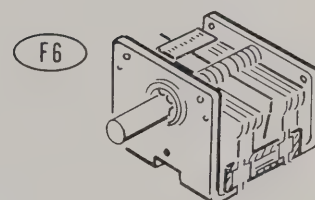
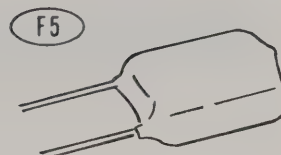
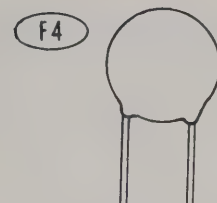
G21



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
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## CAPACITORS

F4	(✓)	1	.05 $\mu$ F disc capacitor	21-143	C304
F5	(✓)	1	.47 $\mu$ F Mylar capacitor	27-86	C305
F6	(✓)	1	Preselector tuning capacitor	26-151	C301A/B
F7	(✓)	1	VFO tuning capacitor	26-152	C302A/B
F8	(✓)	1	Loading capacitor	26-154	C303

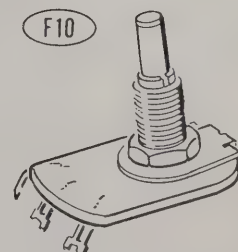
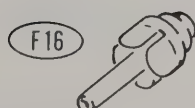
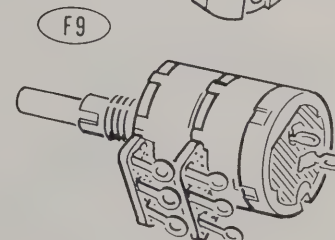
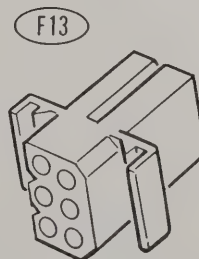
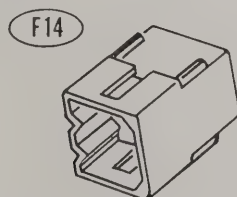


## CONTROL-SWITCH

F9	(✓)	1	10 k $\Omega$ /1000 $\Omega$ control with switch	14-17	R301, R302, S301
F10	(✓)	1	Rotary switch	63-3	SW302

## CONNECTOR-PIN-JACK-PLUG

F11	(✓)	2	Male connector pin	432-72	
F12	(✓)	2	Female connector pin	432-73	
F13	(✓)	1	Chassis connector	432-94	
F14	(✓)	1	Cable connector	432-95	
F15	(✓)	1	Antenna socket	434-107	J302
F16	(✓)	2	Antenna plug	438-4	
F17	(✓)	2	Jack	436-20	J301, J303



# CHASSIS

## PARTS LIST

Check the remaining parts against the following list. Make a check (✓) in the space provided as you identify each part. The illustrations show what the part looks like. Only the hardware is shown actual size.

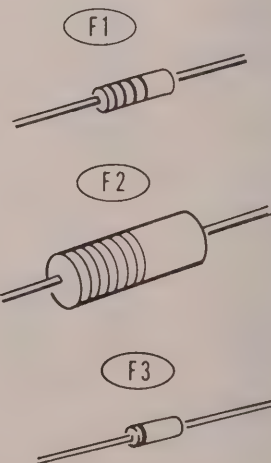
Some parts are packaged in containers with the part number marked on the outside. Except for the initial parts check, keep these parts in their containers so they can be easily identified when they are called for in the assembly steps.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with the kit. If one is not available, see "Replacement Parts" inside the rear cover of this Manual. Your Warranty is located inside the front cover. For pricing information, refer to the separate "Heath Parts Price List."

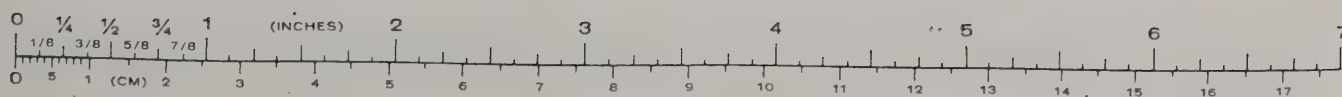
KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

### RESISTORS-DIODES

F1	(✓)	2	1000 (brown-black-red) resistor.	1-9	R303, R304
F1	(✓)	1	47 k $\Omega$ (yellow-violet-orange) resistor.	1-25	R305
F2	(✓)	2	100 $\Omega$ , 2-watt (brown-black-brown) resistor	1-20-2	R306, R307
F3	(✓)	1	1N458 diode	56-24	D301



- ( ) 2" yellow from SW4 pin 2 (S-2) to SW3 pin 2 (NS).
- ( ) 2" yellow from SW3 pin 2 (S-2) to SW2 pin 2 (NS).
- ( ) 2" yellow from SW2 pin 2 (S-2) to SW1 pin 2 (S-1).
- ( ) Group together all of the wires and cables at D on the Pictorial. Then refer to the inset drawing and, using a cable tie as shown, tie all of the wires and cables tightly together.
- ( ) In a similar manner, use cable ties to securely tie together the wires and/or cables at E and F.
- ( ) Position the wires on the circuit board as shown in the Pictorial.
- ( ) This completes the circuit board wiring. Shake out any loose wire clippings or solder splashes. Recheck the circuit board for any solder bridges between adjacent foil patterns. Then set the circuit board aside until it is called for later.



- (✓) At one end of another 7" cable, wrap the inner lead around SW4 pin 3 (S-1) and the shield lead around pin 4 (NS).
- (✓) At the other end of the cable, wrap the shield lead around L4 lug 2 (S-1) and the inner lead around lug 1 (S-1).
- (✓) Refer to Detail 3-2A and prepare a 5-1/2" shielded cable.
- (✓) At one end of the cable, wrap the inner lead around SW4 pin 2 (NS) and the shield lead around lug 4 (S-2). The other end of this cable will be connected later.
- (✓) Refer to Detail 3-2A and prepare a 13-1/2" shielded cable.
- (✓) At one end of this cable, connect the shield lead to the indicated circuit board hole S (S-1) and the inner lead to hole M (S-1). The other end of this cable will be connected later.
- (✓) Refer to Detail 3-2A and prepare a 7" shielded cable.
- (✓) At one end of this cable, connect the shield lead to the other circuit board hole marked S (S-1) and the inner lead to hole L (S-1). The other end of this cable will be connected later.
- (✓) Connect an 8-1/2" wire between circuit board holes J (S-1) and WW (S-1).
- (✓) Connect a 6-1/2" wire between circuit board holes V (S-1) and V (S-1).
- (✓) Install a 1-1/2" wire at the location marked JUMPER. NOTE: Position this wire over R22, the 470 kΩ (yellow-violet-yellow) resistor, as shown.
- (✓) Connect a 3-1/2" wire between circuit board holes U (S-1) and U (S-1).
- (✓) Connect a 10" wire between circuit board holes K (S-1) and B (S-1).
- (✓) Connect an 8" wire from circuit board hole XX (S-1) to switch SW1 pin 6 (NS).
- (✓) Connect a 4" wire from circuit board hole D (S-1) to switch SW4 pin 8 (NS).
- (✓) Connect a 2-1/2" wire from circuit board hole T (S-1) to SW4 pin 6 (NS).
- ( ) Prepare the following yellow wires:

2"	2-1/2"	2"
2"	2-1/2"	2"
2"	2-1/2"	2"

Refer to Pictorial 3-3 in the Illustration Booklet for the following steps.

#### NOTES:

1. Use yellow hookup wire when you perform the following steps. After you connect a wire on the circuit board, solder the wire to the foil and cut off the excess wire lengths.
2. When you connect a wire to one of the pins of the pushbutton switch assembly, wrap the wire around the pin so it makes a secure mechanical connection before you apply any solder.

- ( ) Prepare the following wires:

8-1/2"	10"
6-1/2"	8"
1-1/2"	4"
3-1/2"	2-1/2"

Connect wires between the pins of the pushbutton switch assembly as follows:

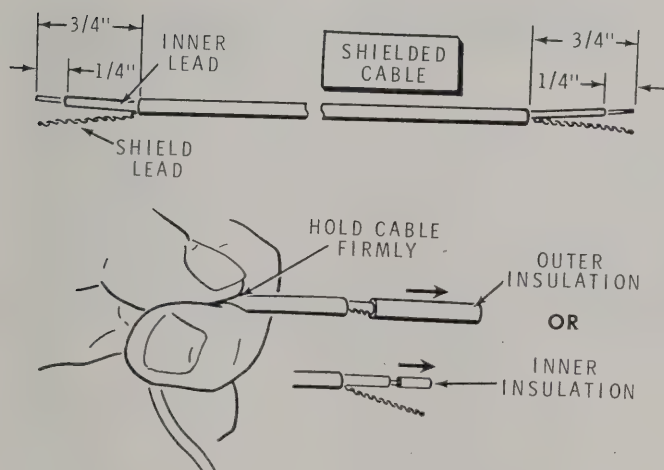
- ( ) 2" yellow from SW1 pin 8 (S-1) to SW2 pin 8 (NS).
- (✓) 2" yellow from SW2 pin 8 (S-2) to SW3 pin 8 (NS).
- (✓) 2" yellow from SW3 pin 8 (S-2) to SW4 pin 8 (S-2).
- (✓) 2-1/2" yellow from SW1 pin 6 (S-2) to SW2 pin 6 (NS).
- (✓) 2-1/2" yellow from SW2 pin 6 (S-2) to SW3 pin 6 (NS).
- (✓) 2-1/2" yellow from SW3 pin 6 (S-2) to SW4 pin 6 (S-2).

Refer to Pictorial 3-2 in the Illustration Booklet for the following steps.

- (+) Connect a 2-1/2" red wire between circuit board holes 2 (S-1) and 2 (S-1).
- (+) Connect a 3-1/2" black wire between circuit board holes 1 (S-1) and 1 (S-1).

#### NOTES:

1. All of the shielded cables used in this kit will have their ends prepared and dimensioned as specified in Detail 3-2A. CAUTION: Hold each cable as shown when you prepare its ends. This will prevent you from pulling the inner lead out of the cable when you remove outer or inner insulation.
2. The step that directs you to prepare a shielded cable will specify its length.



Detail 3-2A

- (+) Refer to Detail 3-2A and prepare a 4" shielded cable.

- ( ) At one end of this cable, connect the shield lead to hole S (S-1) and the inner lead to hole C (S-1). NOTE: These two holes are near the center of the circuit board.

- (+) At the other end of the cable, carefully cut off only the shield lead. Then connect the inner lead to hole H (S-1).

- (+) Refer to Detail 3-2A and prepare four 7" shielded cables.

- ( ) At one end of a 7" shielded cable, wrap the inner lead around SW1 pin 3 (S-1) and the shield lead around pin 4 (S-1).

NOTE: Be very careful when you connect the shielded cables in the following steps. Do not allow the shield wires to touch adjacent coil or switch lugs. Position the leads down between the coils; then carefully wrap the leads around the coil lugs. Solder the leads to the lugs and cut off the excess lead lengths. CAUTION: Use only enough heat and solder to make a good connection.

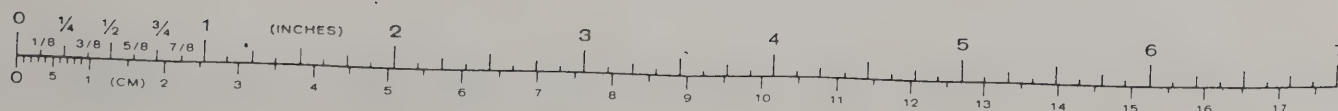
- (+) At the free end of the 7" cable, wrap the shield lead around coil L1 lug 2 (S-1) and the inner lead around lug 1 (S-1).

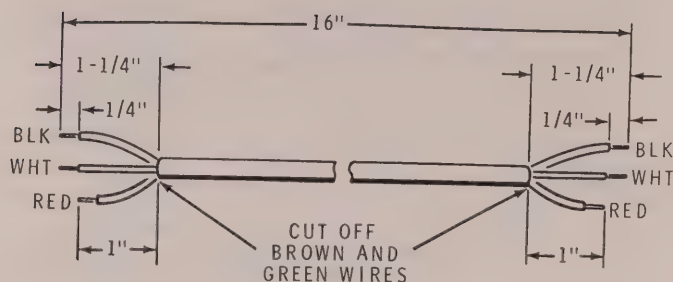
- (+) At one end of another 7" cable, wrap the inner lead around SW2 pin 3 (S-1) and the shield lead around pin 4 (S-1).

- (+) At the other end of the cable, wrap the shield lead around coil L2 lug 2 (S-1) and the inner lead around lug 1 (S-1).

- (+) At one end of another 7" cable, wrap the inner lead around SW3 pin 3 (S-1) and the shield lead around pin 4 (S-1).

- (+) At the other end of the cable, wrap the shield lead around coil L3 lug 2 (S-1) and the inner lead around lug 1 (S-1).





Detail 3-1C

Refer to Detail 3-1C and prepare a 16" cable. At one end of the cable, connect the wires to the following circuit board holes.

Red to hole HH.

Black to hole JJ.

White to hole EE.

The other end of the cable will be connected later.

Refer to Detail 3-1D and prepare an 11" cable.

At the longer prepared end, connect the wires to the following circuit board holes.

White to hole PP.

Black to hole CC.

The green wire, and the wires at the other end of the cable, will be connected later.

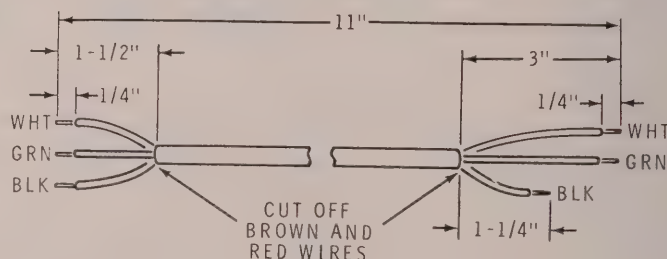
# NOTES:

1. When the hardware is called for in a step, only the screw size will be given. For instance, if 6-32 x 1/4" hardware is called for, it means to use a 6-32 x 1/4" screw, one or more #6 lockwashers, and a 6-32 nut. The Detail, inset drawing, or Pictorial referred to in the steps will show the proper number of lockwashers and the type of screw to use.

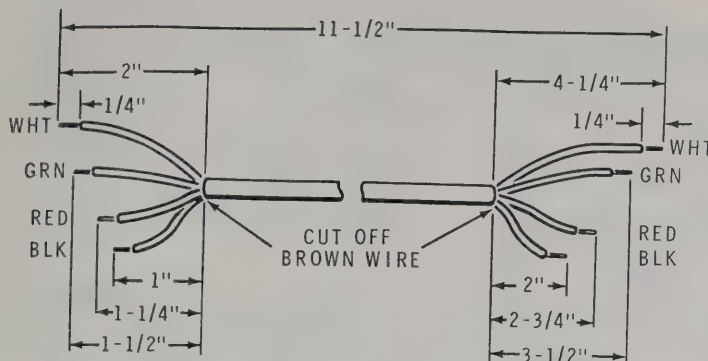
2. Use the plastic nut starter supplied with the kit to hold and start 6-32 and 4-40 nuts on screws.

Refer to the inset drawing on Pictorial 3-1 and mount an angle bracket (#204-1844) on the upper edge of the circuit board. Use 6-32 x 1/4" hardware at the three locations shown. Tighten the hardware only finger tight.

Move the angle bracket as far as it will go away from the edge of the circuit board. Then tighten the screws.



Detail 3-1D



Detail 3-1B

- ( ) Refer to Detail 3-1B and prepare an 11-1/2" cable as shown.

Connect the wires at the shorter prepared end of the cable to the following circuit board holes.

- ( ) Black to hole N.
- ( ) Red to hole P.
- ( ) Green to hole Q.
- ( ) White to hole R.

At the other end of the cable, connect the wires to the pushbutton switch assembly as follows:

- ( ) Black to SW1 pin 5 (S-1).
- ( ) Red to SW2 pin 5 (S-1).
- ( ) Green to SW3 pin 5 (S-1).
- ( ) White to SW4 pin 5 (S-1).
- ( ) Cut an 8-1/2" length off the remaining length of 5-wire cable. Then carefully remove all of the outer insulation from the 8-1/2" length. These cable wires will be used in the following steps.

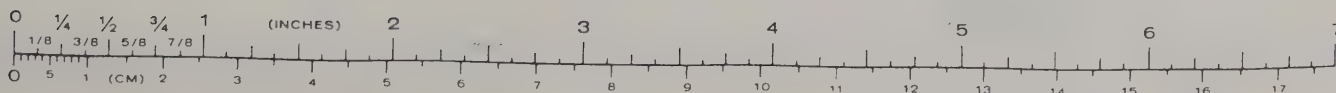
**NOTE:** When you prepare a stranded wire, cut it to the length specified in the step and remove 1/4" of insulation from each end. Then twist the strands and apply a small amount of solder to the wire ends to hold the strands together.

You may prefer to prepare wires ahead of time, as in the following step. The wires are listed in the order in which they are used. Save the remaining wires for use later.

- ( ) Prepare the following wires:

2-1/2" white	3-1/2" red
2-1/2" white	5" black
2-1/2" green	2-3/4" green

- ( ) Connect a 2-1/2" white wire between circuit board holes 4 (S-1) and 4 (S-1).
- ( ) Connect a 2-1/2" white wire from switch SW4 pin 9 (S-2) to circuit board hole 8 (S-1).
- ( ) Connect a 2-1/2" green wire from switch SW3 pin 9 (S-2) to circuit board hole 7 (S-1).
- ( ) Connect a 3-1/2" red wire from switch SW2 pin 9 (S-2) to circuit board hole 6 (S-1).
- ( ) Connect a 5" black wire from switch SW1 pin 9 (S-2) to circuit board hole 5 (S-1).
- ( ) Connect a 2-3/4" green wire between circuit board holes 3 (S-1) and 3 (S-1).
- ( ) Position the cable wires connected to the pushbutton switch assembly down between the switch pins and against the body of the switches. Position the circuit board wires as shown on the Pictorial.



## CIRCUIT BOARD WIRING

## NOTES:

1. In the following steps, you will use the 5-wire cable supplied with the kit to prepare four multiwire cables. Each cable will be connected to the circuit board as soon as it is prepared.

**CAUTION:** When you prepare a multiwire cable in the following steps, grip the cable securely when you remove insulation from one of the wires. This will prevent you from pulling one of the wires out of the cable.

2. When you prepare the ends of the cable wires, cut each wire to the length indicated in the appropriate Detail and remove 1/4" of insulation from each end of each wire. Then twist the strands and apply a small amount of solder to the wire ends to hold the strands together.
3. Solder each wire to the foil as it is connected to the circuit board. Then cut off the excess wire lengths.

Refer to Pictorial 3-1 in the Illustration Booklet for the following steps.

- ( ) Refer to Detail 3-1A and prepare an 8" cable as shown.

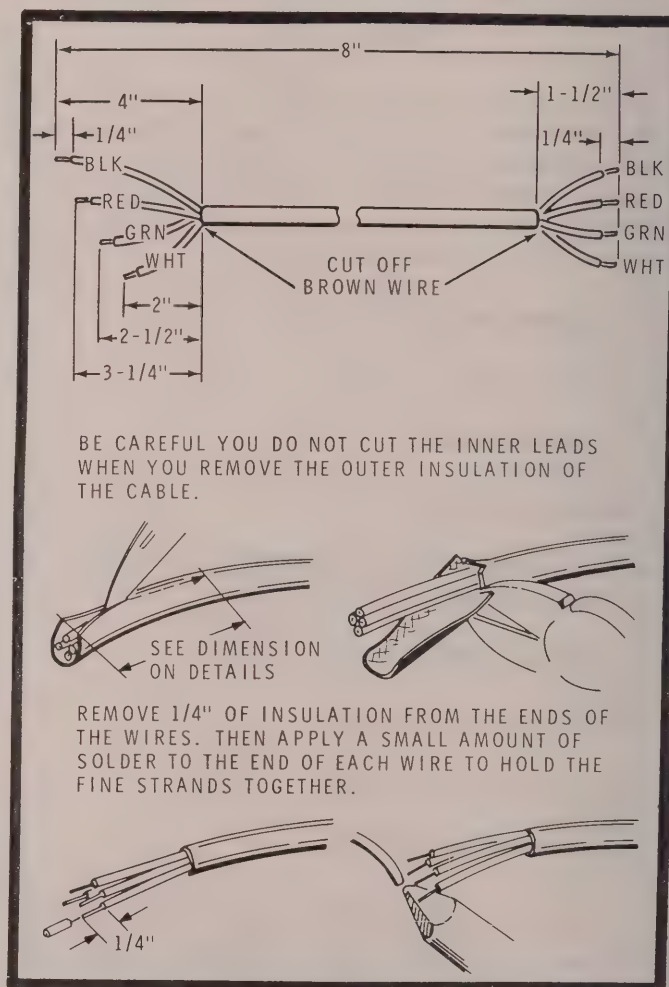
Connect the wires at the shorter prepared end of this cable to the following circuit board holes.

- ( ) White to hole NN.
- ( ) Green to hole MM.
- ( ) Red to hole LL.
- ( ) Black to hole KK.

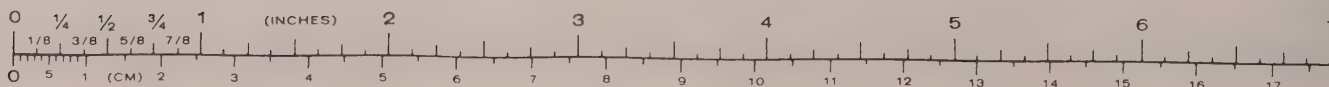
**NOTE:** In the following steps, (NS) means not to solder because another wire (or wires) will be added later. The letter S with a number, such as (S-2), means to solder the connection. The number that follows the letter S indicates the number of wires at that connection.

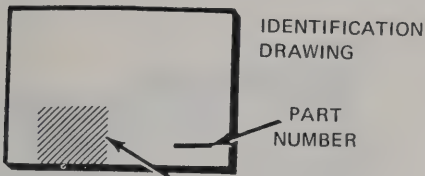
Connect the wires at the free end of the 8" cable to the pushbutton switch assembly as follows. Wrap each wire around the pin so it makes a secure mechanical connection before you solder the wire to the pin.

- ( ) White to switch SW4 pin 9 (NS).
- ( ) Green to switch SW3 pin 9 (NS).
- ( ) Red to switch SW2 pin 9 (NS).
- ( ) Black to switch SW1 pin 9 (NS).



Detail 3-1A





The steps performed in this Pictorial are in this area of the circuit board.

## START

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

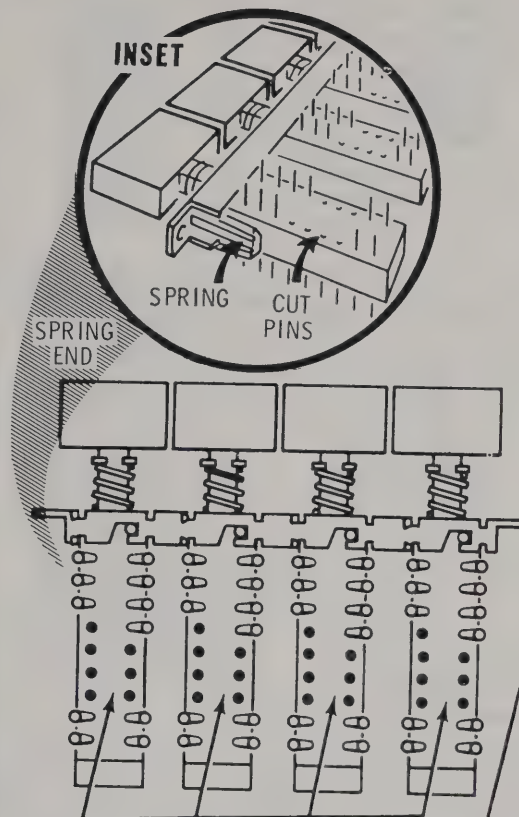
WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



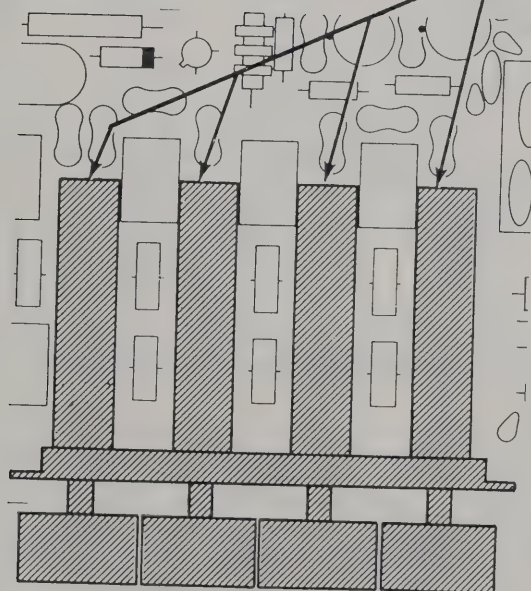
NOTE: There is a spring at one end of the pushbutton switch assembly. (See inset drawing.) When you perform the next two steps, be sure you position the switch assembly so its spring end is toward your left as shown.

(1) Position the pushbutton switch assembly so its spring end is toward your left as shown in Detail 2-18A.

(2) Very carefully cut the indicated pins off each of the four switches. Cut them as close as possible to the body of each switch.



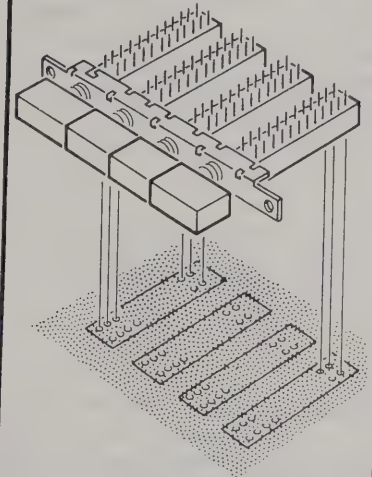
DETAIL 2-18A



PICTORIAL 2-18

## CONTINUE

Turn the switch assembly over and line up the remaining pins with their respective holes in the circuit board.



Start the pins into the circuit board holes. Then press the switch assembly tight against the circuit board. Also, make sure the assembly is parallel with the circuit board. Then turn the assembly over and solder two lugs on each end of the switch assembly. Check the switch assembly to make sure it is straight. If the assembly is straight, solder the other switch lugs. Cut off the excess lugs from the foil side of the board.

## CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

- (1) Unsoldered connections.
- (2) "Cold" solder connections.
- (3) Solder bridges between foil patterns.
- (4) Protruding leads which could touch together.
- (5) Transistors for the proper type and installation.
- (6) Electrolytic capacitors for the correct position of the positive (+) end.
- (7) Diodes for the correct position of the banded end.

## FINISH

The steps performed in this Pictorial are in this area of the circuit board.

PART  
NUMBER

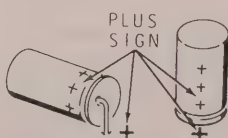
IDENTIFICATION  
DRAWING



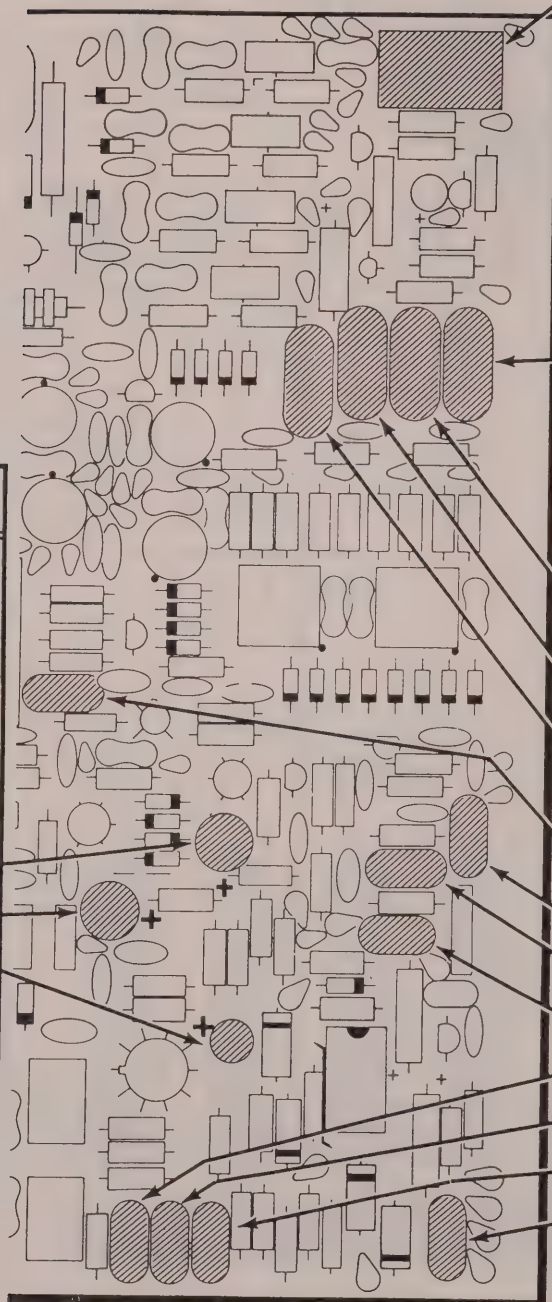
## START

Note the different position of the circuit board in this Pictorial.

NOTE: When you install an electrolytic capacitor, always connect the lead at the positive (+) end of capacitor to the positive (+) marked point on the circuit board.



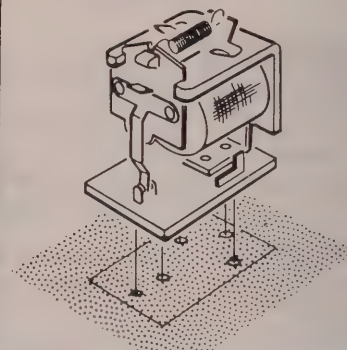
- (✓) C41: 100  $\mu$ F electrolytic.
- (✓) C32: 100  $\mu$ F electrolytic.
- (✓) C33: 10  $\mu$ F electrolytic.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.



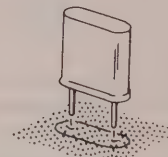
## CONTINUE

NOTE: In the following five steps, solder the pins to the foil as you install each part.

- (✓) RY1: Relay (#69-47). CAUTION: Do not bend any of the mechanical parts on the relay.



- (✓) Y1: 12.395 MHz crystal (#404-207).



- (✓) Y2: 15.895 MHz crystal (#404-208).

- (✓) Y3: 22.895 MHz crystal (#404-209).

- (✓) Y4: 29.895 MHz crystal (#404-210).

Install eight .1  $\mu$ F Mylar capacitors.

- (✓) C74.
- (✓) C112.
- (✓) C111.
- (✓) C113.
- (✓) C27.
- (✓) C26.
- (✓) C31.
- (✓) C39.

- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-17

The steps performed in this Pictorial are in this area of the circuit board.

PART  
NUMBER

IDENTIFICATION  
DRAWING

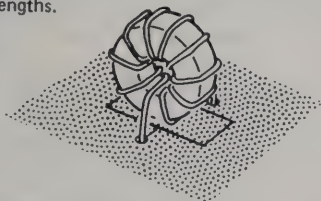
## START

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



NOTE: When you install a coil in the following steps, keep it within the coil outline on the circuit board. Solder the leads to the foil and cut off the excess lead lengths.



✓ L8: 1.3  $\mu$ H toroid coil (#40-1800).

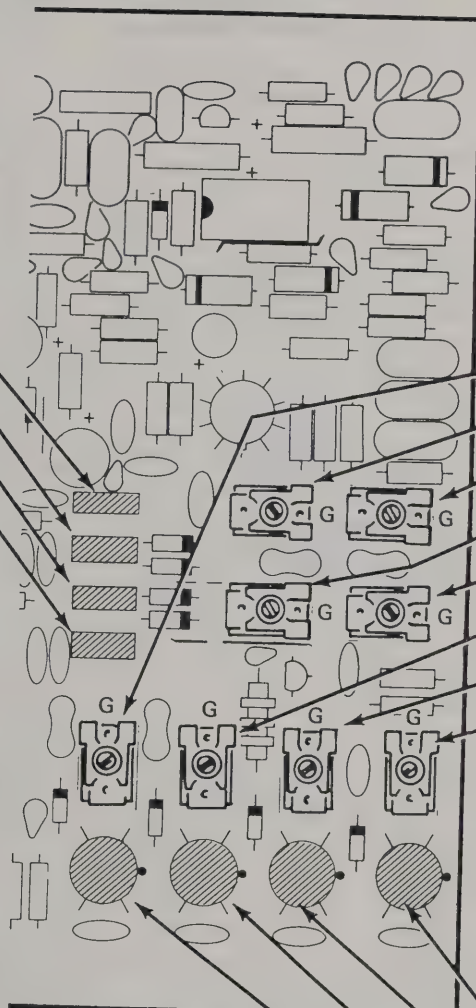
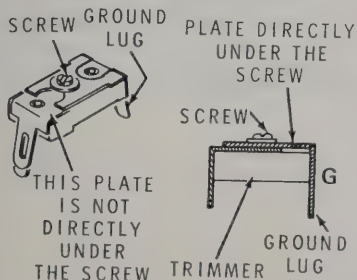
( ) L7: 1.8  $\mu$ H toroid coil (#40-1792).

✓ L6: 4.2  $\mu$ H toroid coil (#40-1798).

( ) L5: 15.5  $\mu$ H toroid coil (#40-1882).

### NOTES:

1. You will install four trimmer capacitors on the circuit board in the following steps. Note that there are two different values of trimmers.
2. Some of the trimmer lugs have two or more leaves. When you install the trimmers, make sure all of the lug leaves go through the circuit board.
3. IT IS VERY IMPORTANT to solder the correct trimmer lug to the correct foil. One lug on each trimmer will be called the ground lug (G). This is the lug that is connected to the metal plate directly under the screw on the trimmer.

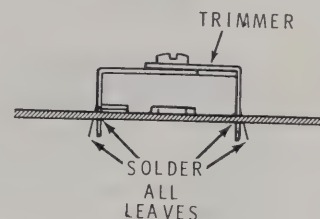


PICTORIAL 2-16

## CONTINUE

NOTES: (cont'd.)

4. Make sure that each trimmer capacitor is properly positioned and soldered to the foil. If a trimmer lug has more than one leaf, make sure all leaves are soldered.



✓ C3: 8-60 pF trimmer (#31-52).

( ) C24: 8-60 pF trimmer (#31-52).

( ) C22: 8-60 pF trimmer (#31-52).

( ) C19: 4-40 pF trimmer (#31-54).

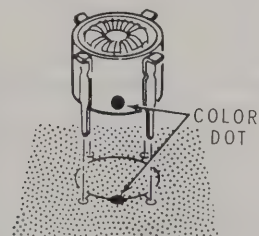
( ) C16: 4-40 pF trimmer (#31-54).

( ) C6: 4-40 pF trimmer (#31-54).

( ) C7: 8-60 pF trimmer (#31-52).

( ) C9: 8-60 pF trimmer (#31-52).

Install four toroid coils as shown below.



( ) L4: 1.8  $\mu$ H toroid coil (#40-1788).

( ) L3: 1.8  $\mu$ H toroid coil (#40-1788).

✓ L2: 4.7  $\mu$ H toroid coil (#40-1787).

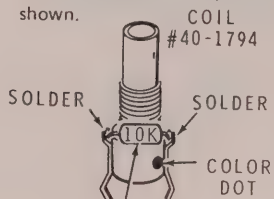
( ) L1: 13  $\mu$ H toroid coil (#40-1786).

( ) Solder the lugs to the foil.

# START

1. Locate a 10 k $\Omega$  (brown-black-orange) resistor, and coil #40-1794.

2. Refer to the following drawing and solder the 10 k $\Omega$  resistor between the lugs of the coil. NOTE: Be sure you mount the resistor so the color dot on the coil is positioned as shown.



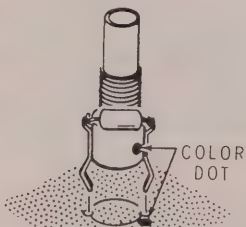
10K $\Omega$  RESISTOR

## NOTES:

1. In the following steps, be sure you position the color dot on the coil toward the dot of the coil outline on the circuit board.

2. Solder the pins to the foil as you install each part.

3. L13/R50: Mount the coil-resistor combination at L13.

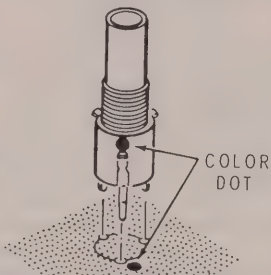


4. L14: 4  $\mu$ H coil (#40-1795).

5. L15: 1.3  $\mu$ H coil (#40-1796).

6. L16: 1.3  $\mu$ H coil (#40-1796).

7. L9: 5  $\mu$ H coil (#40-1802).

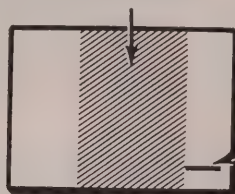


8. L33: 1.3  $\mu$ H toroid coil (#40-1800).

9. L34: 1.3  $\mu$ H toroid coil (#40-1800).

10. Solder the leads to the foil and cut off the excess lead lengths.

The steps performed in this Pictorial are in this area of the circuit board.

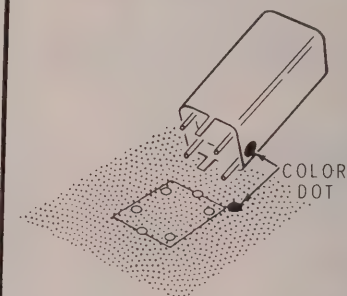


IDENTIFICATION DRAWING

PART NUMBER

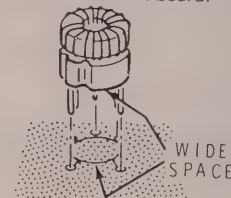
# CONTINUE

11. L17/L18: 80/40 meter heterodyne oscillator coil (#40-1803).



12. L19/L21: 20/15 meter heterodyne oscillator coil (#40-1804).

13. L12: 15  $\mu$ H toroid coil (#40-1050). Match the color dot on the wide space on the circuit board.

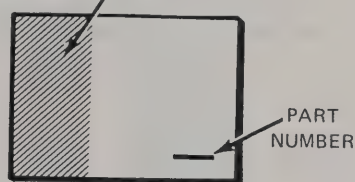


14. L11: 15  $\mu$ H toroid coil (#40-1050).

15. Be sure the shield cans of coils L17, L18, L19, and L21 do not touch the leads of the resistors at the left side of the coils. If necessary, use a small screwdriver and very carefully press the bottom edge of each shield just far enough away from the resistor leads so they do not touch.

PICTORIAL 2-15

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION  
DRAWING

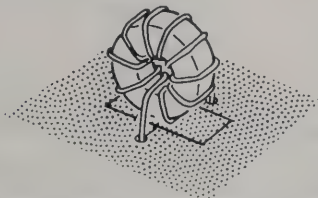
## START

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



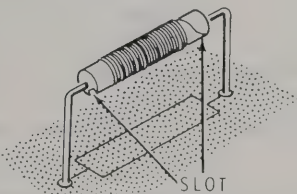
NOTE: When you install a coil in the following steps, keep it within the outline on the circuit board. Solder the leads to the foil and cut off the excess lead lengths as each coil is installed.



( ) 9  $\mu$ H coil (#40-1797) at L22.

( ) 4.2  $\mu$ H coil (#40-1798) at L23.

( ) 26  $\mu$ H choke (#45-62) at RFC3.  
Bend the leads toward the slot as shown.



( ) C93: .47  $\mu$ F Mylar.

( ) Solder the leads to the foil and cut off the excess lead lengths.

( ) L26: 15.5  $\mu$ H coil (#40-1882).

( ) L27: 27.5  $\mu$ H coil (#40-1791).

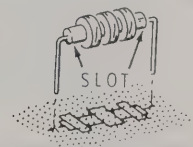
( ) L29: 7  $\mu$ H coil (#40-1726).

## CONTINUE

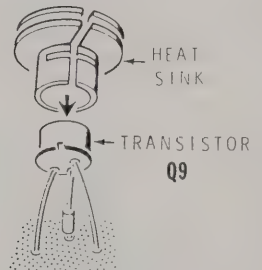
( ) L24: 1.8  $\mu$ H coil (#40-1792).

( ) L25: 1.3  $\mu$ H coil (#40-1800).

( ) RFC2: 350  $\mu$ H choke (#45-82).  
CAUTION: Bend the leads toward the slot in the core.



( ) Place heat sink (#215-45) on transistor Q9 as shown.



( ) L31: 2.5  $\mu$ H coil (#40-1609).

( ) L32: 2.5  $\mu$ H coil (#40-1609).

( ) L28: 7  $\mu$ H coil (#40-1726).

PICTORIAL 2-14

The steps performed in this Pictorial are in this area of the circuit board.



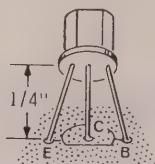
PART  
NUMBER

IDENTIFICATION  
DRAWING

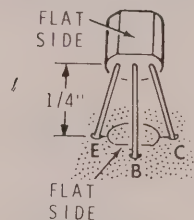
## START

(✓) Q12: MPS-A20 transistor (#417-801).

(✓) Q13: X29A829 transistor (#417-201).

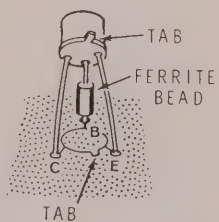


( ) Q11: S2091 transistor (#417-116).



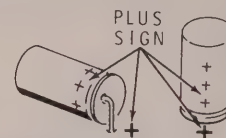
(✓) Q8: MPS6521 transistor (#417-172).

(✓) Q9: 2N4427 transistor (#417-880). Place a ferrite bead on the B (base) lead. Then mount the transistor as shown.



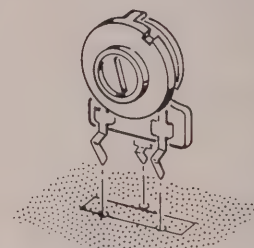
## CONTINUE

NOTE: When you install an electrolytic capacitor, always connect the lead at the positive (+) end of the capacitor to the positive (+) marked point on the circuit board.



(✓) C92: 10  $\mu$ F electrolytic.

( ) R68: 50 k $\Omega$  control (#10-222).

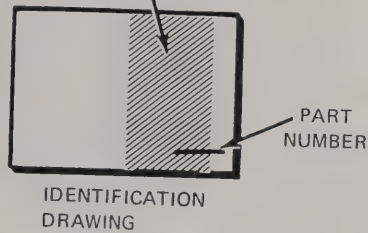


(✓) C91: 2  $\mu$ F electrolytic.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

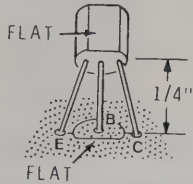
PICTORIAL 2-13

The steps performed in this Pictorial are in this area of the circuit board.



# START

NOTE: When you install a transistor, line up the flat or tab on the transistor with the outline of the flat or tab on the circuit board. Then insert the leads in the corresponding holes in the circuit board. Position it 1/4" above the circuit board; then solder the leads to the foil and cut off the excess lead lengths.



( / Q6: MPS-6521 transistor (#417-172).

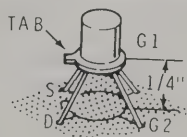
Install two MPS-A20 transistors (#417-801).

( / Q14.

( / Q7.

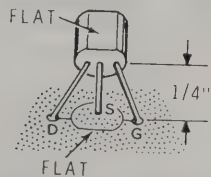
( / Q5: MPS-A20 transistor (#417-801).

( ) Q4: 40673 transistor (#417-240).



( / Q3: MPS-A20 transistor (#417-801).

( / Q1: MPF-105 transistor (#417-169).

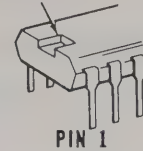


( / Q2: MPF-105 transistor (#417-169).

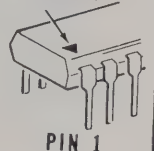
# CONTINUE

NOTE: The indexed (pin 1) end of inline integrated circuits may be marked in a number of ways such as a notch, triangle, dot, the numeral 1, etc.

## NOTCH



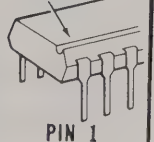
## TRIANGLE



## SMALL INDENTATION OR DOT

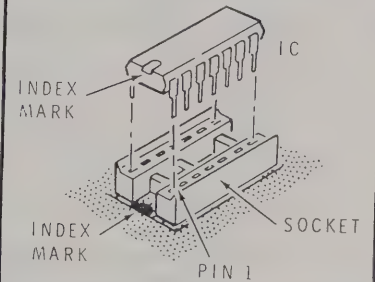


## RIDGE



Be sure you install the IC so its indexed end is toward the index mark printed on the circuit board.

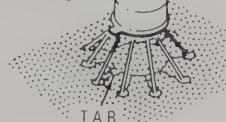
Before you apply downward pressure to an IC, make sure each IC pin is centered in its proper socket hole. Handle IC's with care as their pins are very easily bent.



( / IC2: LM3900 integrated circuit (#442-71).

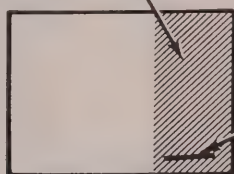
( / IC1: MC1496G integrated circuit (#442-96). Line up the tab on the IC with the outline of the tab on the circuit board; then insert the leads in their respective holes, 1 through 10, on the circuit board. Solder the leads to the foil and cut off the excess lead lengths.

## LOCATING TAB



PICTORIAL 2-12

The steps performed in this Pictorial are in this area of the circuit board



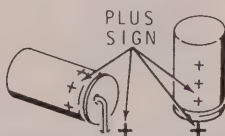
IDENTIFICATION  
DRAWING

## START

( ) C43: .05  $\mu$ F disc.

( ) C109: .022  $\mu$ F Mylar.

NOTE: When you install an electrolytic capacitor, always connect the lead at the positive (+) end of the capacitor to the positive (+) marked point on the circuit board.



( ) C42: 2  $\mu$ F electrolytic.

( ) C38: 2  $\mu$ F electrolytic.

( ) C128: .05  $\mu$ F disc.

( ) C59: .05  $\mu$ F disc.

( ) C57: .05  $\mu$ F disc.

( ) Solder the leads to the foil and cut off the excess lead lengths.

( ) C23: .05  $\mu$ F disc.

( ) C21: .05  $\mu$ F disc.

( ) C17: .05  $\mu$ F disc.

( ) C14: .05  $\mu$ F disc.

( ) C1: 68 pF mica.

( ) C4: 68 pF mica.

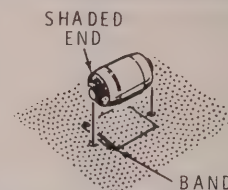
( ) C2: .05  $\mu$ F disc.

( ) C5: .05  $\mu$ F disc.

( ) Solder the leads to the foil and cut off the excess lead lengths.

## CONTINUE

NOTE: In the following four steps, be sure you position each capacitor so its shaded end is toward the banded end of the outline on the circuit board, as shown.



( ) C36: 1000 pF polystyrene.

( ) C37: 1000 pF polystyrene.

( ) C34: 1800 pF polystyrene.

( ) C35: 1800 pF polystyrene.

( ) C29: .05  $\mu$ F disc.

( ) C28: .05  $\mu$ F disc.

( ) C25: 10 pF disc.

( ) Solder the leads to the foil and cut off the excess lead lengths.

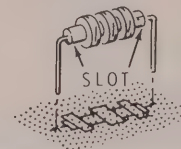
( ) C15: 47 pF mica.

( ) C18: 75 pF mica.

( ) C13: .05  $\mu$ F disc.

( ) C12: 3.3 pF disc.

( ) RFC1: 350  $\mu$ H choke (#45-82).  
CAUTION: Bend the leads toward the slot in the core.



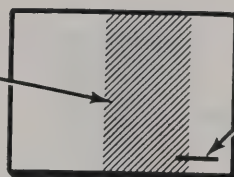
( ) C11: .05  $\mu$ F disc.

( ) C8: .05  $\mu$ F disc.

( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-11

The steps performed in this Pictorial are in this area of the circuit board.



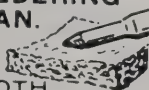
PART  
NUMBER

IDENTIFICATION  
DRAWING

## START

FOR GOOD SOLDER CONNECTIONS, YOU MUST  
**KEEP THE SOLDERING  
IRON TIP CLEAN.**

WIPE IT OFTEN  
WITH A DAMP  
SPONGE OR CLOTH.



(✓) C116: 100 pF mica.

(✓) C118: 130 pF mica.

(✓) C121: 47 pF mica.

(✓) C58: .05  $\mu$ F disc.

(✓) C73: 3.3 pF disc.

(✓) C123: 24 pF mica.

(✓) C65: .05  $\mu$ F disc.

(✓) C72: .05  $\mu$ F disc.

(✓) Solder the leads to the foil and cut  
off the excess lead lengths.

(✓) C47: 6.8 pF disc.

(✓) C75: .05  $\mu$ F disc.

(✓) C51: 56 pF disc.

(✓) C54: 3.3 pF disc.

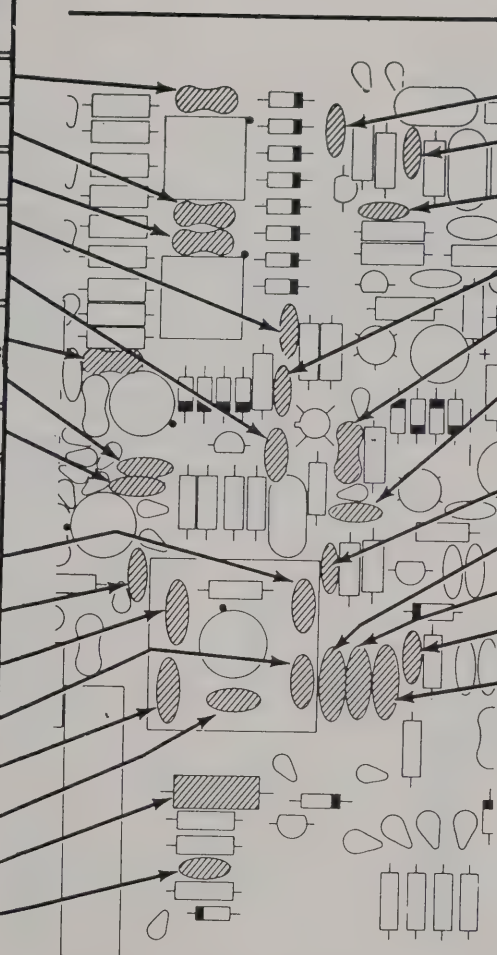
(✓) C49: 56 pF disc.

(✓) C48: 27 pF disc.

(✓) C53: 4.7 pF ceramic.

(✓) C55: 6 pF disc.

(✓) Solder the leads to the foil and cut  
off the excess lead lengths.



## CONTINUE

(✓) C125: 5 pF disc.

(✓) C126: 10 pF disc.

(✓) C127: 3.3 pF disc.

(✓) C63: .05  $\mu$ F disc.

(✓) C61: 100 pF mica.

(✓) C62: .05  $\mu$ F disc.

(✓) Solder the leads to the foil and cut  
off the excess lead lengths.

(✓) C52: .05  $\mu$ F disc.

(✓) C44: 510 pF disc.

(✓) C45: 510 pF disc.

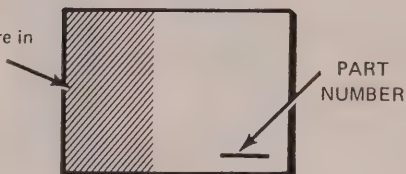
(✓) C56: .05  $\mu$ F disc.

(✓) C46: 510 pF disc.

(✓) Solder the leads to the foil and cut  
off the excess lead lengths.

PICTORIAL 2-10

The steps performed in this Pictorial are in this area of the circuit board.

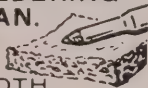


IDENTIFICATION  
DRAWING

## START

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



(✓) C87: 47 pF mica.

(✓) C84: 130 pF mica.

(✓) C81: 470 pF mica.

(✓) C114: 270 pF mica.

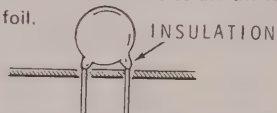
(✓) C82: 230 pF mica.

(✓) C77: 680 pF mica.

(✓) C78: 330 pF mica.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

NOTE: When you install disc capacitors, do not push the insulated portions of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.



(✓) C79: .05  $\mu$ F disc.

(✓) C83: .05  $\mu$ F disc.

(✓) C85: 130 pF mica.

(✓) C86: .05  $\mu$ F disc.

(✓) C96: 150 pF mica.

(✓) C94: 270 pF mica.

(✓) C97: 680 pF mica.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

## CONTINUE

(✓) C115: .05  $\mu$ F disc.

(✓) C117: .05  $\mu$ F disc.

(✓) C89: .05  $\mu$ F disc.

(✓) C119: .05  $\mu$ F disc.

(✓) C76: .05  $\mu$ F disc.

(✓) C66: 150 pF mica.

(✓) C122: .05  $\mu$ F disc.

(✓) C64: 230 pF mica.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

(✓) C67: .05  $\mu$ F disc.

(✓) C69: .05  $\mu$ F disc.

(✓) C71: 47 pF mica.

(✓) C68: 100 pF mica.

(✓) C107: 100 pF mica.

(✓) C108: 150 pF mica.

(✓) C104: 75 pF mica.

(✓) C88: 47 pF mica.

(✓) C105: 200 pF mica.

(✓) C98: 100 pF mica.

(✓) C101: 100 pF mica.

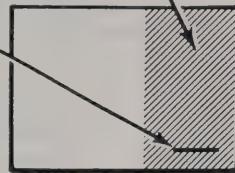
(✓) C102: 400 pF mica.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-9

The steps performed in this Pictorial are in this area of the circuit board.

PART  
NUMBER



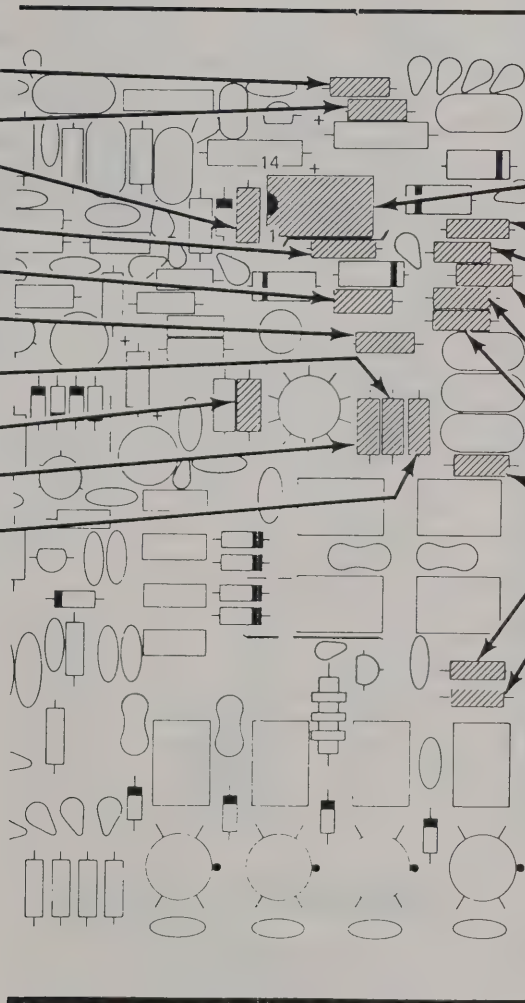
IDENTIFICATION  
DRAWING

### START

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN. WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.

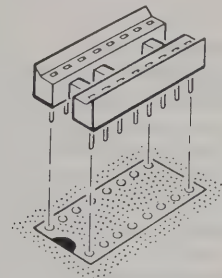


- ( ) R29: 22 k $\Omega$  (red-red-orange).
- ( ) R27: 1 M $\Omega$  (brown-black-green).
- ( ) R72: 3.3 M $\Omega$  (orange-orange-green).
- ( ) R22: 470 k $\Omega$  (yellow-violet-yellow).
- ( ) R19: 47 k $\Omega$  (yellow-violet-orange).
- ( ) R15: 10 k $\Omega$  (brown-black-orange).
- ( ) R8: 1000  $\Omega$  (brown-black-red).
- ( ) R13: 47  $\Omega$  (yellow-violet-black).
- ( ) R14: 100  $\Omega$  (brown-black-brown).
- ( ) R12: 1000  $\Omega$  (brown-black-red).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.



### CONTINUE

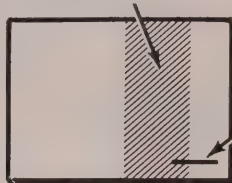
NOTE: To install an IC socket be sure the socket pins are straight. Then insert the socket pins and solder them to the foil.



- (✓) 14-pin IC socket at IC2.
- (✓) R25: 1 M $\Omega$  (brown-black-green).
- (✓) R23: 470 k $\Omega$  (yellow-violet-yellow).
- (✓) R24: 82 k $\Omega$  (gray-red-orange).
- (✓) R21: 82 k $\Omega$  (gray-red-orange).
- (✓) R9: 1200  $\Omega$  (brown-red-red).
- (✓) R7: 1000  $\Omega$  (brown-black-red).
- (✓) R6: 270  $\Omega$  (red-violet-brown).
- (✓) R5: 100 k $\Omega$  (brown-black-yellow).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-8

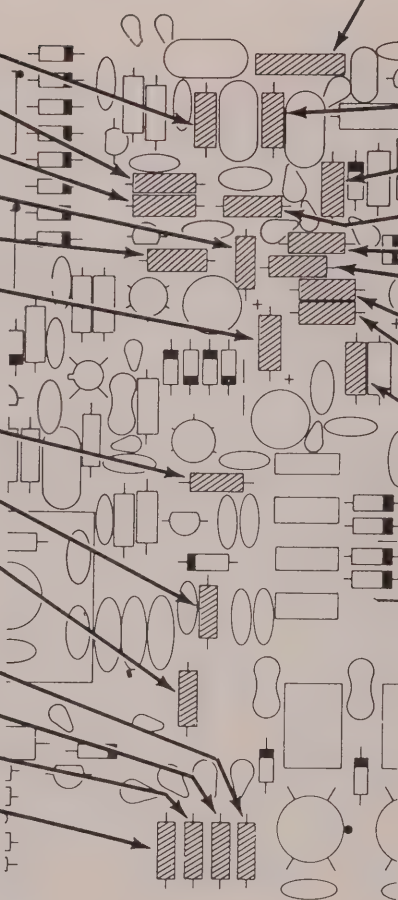
The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION  
DRAWING

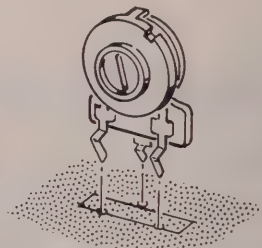
**START** →

- (✓) R76: 1000  $\Omega$  (brown-black-red).
- (✓) R95: 22 k $\Omega$  (red-red-orange).
- (✓) R94: 68 k $\Omega$  (blue-gray-orange).
- (✓) R26: 2.2 M $\Omega$  (red-red-green).
- (✓) R42: 100  $\Omega$  (brown-black-brown).
- (✓) R18: 100  $\Omega$  (brown-black-brown).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) R41: 100  $\Omega$  (brown-black-brown).
- (✓) R37: 22 k $\Omega$  (red-red-orange).
- (✓) R35: 470  $\Omega$  (yellow-violet-brown).
- Install four 1000  $\Omega$  (brown-black-red) resistors.
- (✓) R1. ....
- (✓) R2. ....
- (✓) R3. ....
- (✓) R4. ....
- (✓) Solder the leads to the foil and cut off the excess lead lengths.



**CONTINUE** →

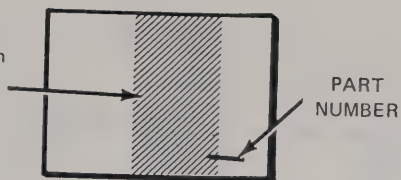
- (✓) R77: 1000  $\Omega$  control (#10-936). Solder the lugs to the foil.



- (✓) R75: 47 k $\Omega$  (yellow-violet-orange).
- (✓) R74: 10 M $\Omega$  (brown-black-blue).
- (✓) R96: 100  $\Omega$  (brown-black-brown).
- (✓) R73: 10 M $\Omega$  (brown-black-blue).
- (✓) R28: 100  $\Omega$  (brown-black-brown).
- (✓) R17: 2700  $\Omega$  (red-violet-red).
- (✓) R16: 2700  $\Omega$  (red-violet-red).
- (✓) R11: 820  $\Omega$  (gray-red-brown).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-7

The steps performed in this Pictorial are in this area of the circuit board.

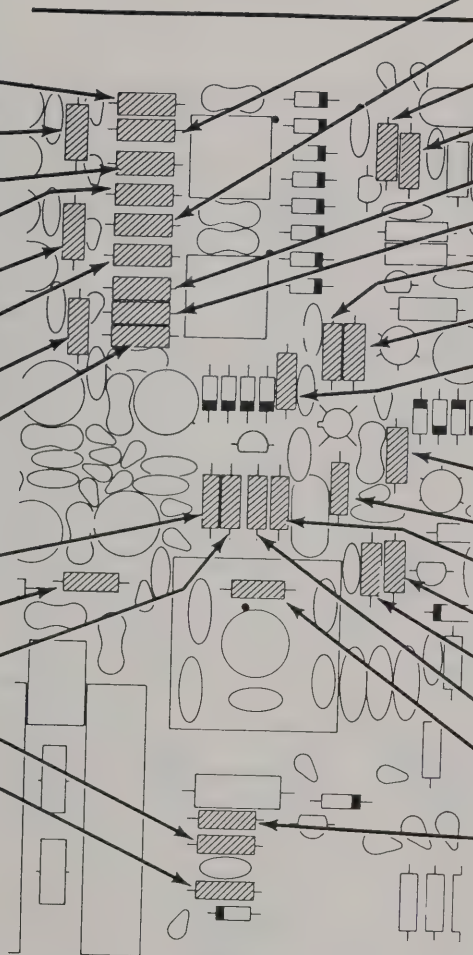
**START** ➡

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



- (✓) R79: 6800  $\Omega$  (blue-gray-red).
- (✓) R81: 100 k $\Omega$  (brown-black-yellow).
- (✓) R83: 6800  $\Omega$  (blue-gray-red).
- (✓) R82: 1000  $\Omega$  (brown-black-red).
- (✓) R84: 100 k $\Omega$  (brown-black-yellow).
- (✓) R85: 1000  $\Omega$  (brown-black-red).
- (✓) R87: 100 k $\Omega$  (brown-black-yellow).
- (✓) R91: 100 k $\Omega$  (brown-black-yellow).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) R51: 100  $\Omega$  (brown-black-brown).
- (✓) R52: 22 k $\Omega$  (red-red-orange).
- (✓) R49: 270  $\Omega$  (red-violet-brown).
- (✓) R34: 470  $\Omega$  (yellow-violet-brown).
- (✓) R36: 1000  $\Omega$  (brown-black-red).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

IDENTIFICATION  
DRAWING**CONTINUE** ➡

- (✓) R78: 1000  $\Omega$  (brown-black-red).
- (✓) R86: 6800  $\Omega$  (blue-gray-red).
- (✓) R92: 3300  $\Omega$  (orange-orange-red).
- (✓) R93: 470  $\Omega$  (yellow-violet-brown).
- (✓) R89: 6800  $\Omega$  (blue-gray-red).
- (✓) R88: 1000  $\Omega$  (brown-black-red).
- (✓) R44: 47 k $\Omega$  (yellow-violet-orange).
- (✓) R45: 100 k $\Omega$  (brown-black-yellow).
- (✓) R46: 100  $\Omega$  (brown-black-brown).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) R39: 100  $\Omega$  (brown-black-brown).
- (✓) R43: 100 k $\Omega$  (brown-black-yellow).
- (✓) R47: 47 k $\Omega$  (yellow-violet-orange).
- (✓) R38: 68 k $\Omega$  (blue-gray-orange).
- (✓) R33: 470  $\Omega$  (yellow-violet-brown).
- (✓) R48: 47 k $\Omega$  (yellow-violet-orange).
- (✓) R31: 47  $\Omega$  (yellow-violet-black).
- (✓) R32: 1 M $\Omega$  (brown-black-green).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-6

The steps performed in this Pictorial are in this area of the circuit board.

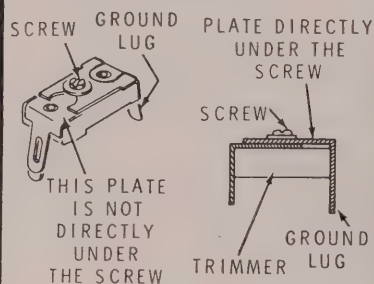


IDENTIFICATION  
DRAWING

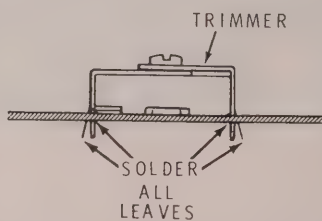
## START

### NOTES:

1. You will install four trimmer capacitors on the circuit board in the following steps. Note that there are two different values of trimmers.
2. Some of the trimmer lugs have two or more leaves. When you install the trimmer, make sure all of the lug leaves go through the circuit board.
3. IT IS VERY IMPORTANT to solder the correct trimmer lug to the correct foil. One lug on each trimmer will be called the ground lug. This is the lug that is connected to the metal plate directly under the screw on the trimmer.



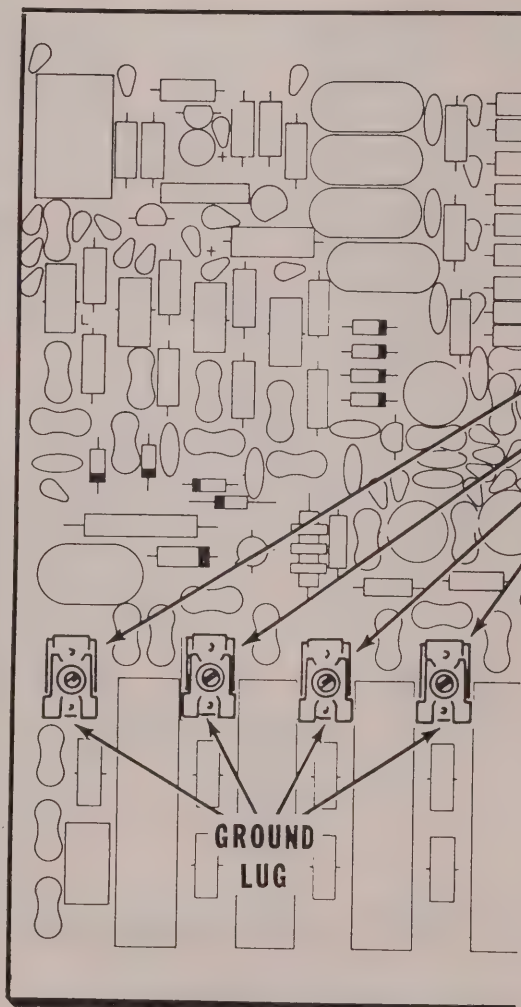
4. Make sure that each trimmer capacitor is properly positioned and soldered to the foil. If a trimmer lug has more than one leaf, make sure all leaves are soldered.



## CONTINUE

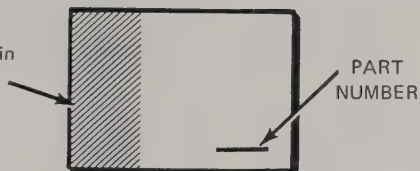
NOTE: In the following steps, solder the lugs to the foil as you install each trimmer.

- (✓) C95: 8-60 pF trimmer (#31-52).
- (✓) C99: 8-60 pF trimmer (#31-52).
- (✓) C103: 8-60 pF trimmer (#31-52).
- (✓) C106: 8-60 pF trimmer (#31-52).



PICTORIAL 2-5

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION  
DRAWING

### START

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



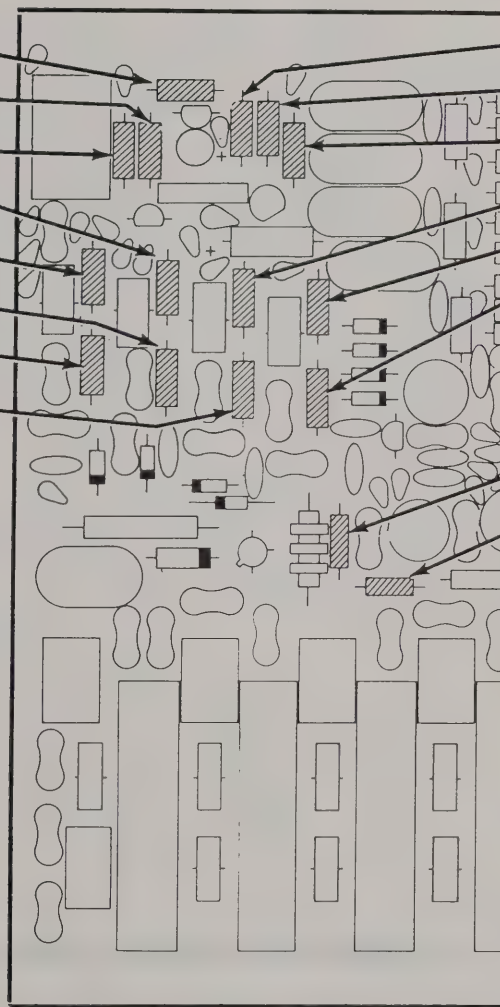
- (✓) R67: 4700  $\Omega$  (yellow-violet-red).
- (✓) R69: 1000  $\Omega$  (brown-black-red).
- 71 (✓) R71: 10 k $\Omega$  (brown-black-orange).
- (✓) R57: 47  $\Omega$  (yellow-violet-black).
- (✓) R54: 47  $\Omega$  (yellow-violet-black).
- (✓) R58: 1000  $\Omega$  (brown-black-red).
- (✓) R56: 470  $\Omega$  (yellow-violet-brown).
- (✓) R61: 1000  $\Omega$  (brown-black-red).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

### CONTINUE

- (✓) R66: 4700  $\Omega$  (yellow-violet-red).
- (✓) R64: 4700  $\Omega$  (yellow-violet-red).
- (✓) R65: 1000  $\Omega$  (brown-black-red).
- (✓) R59: 47  $\Omega$  (yellow-violet-black).
- (✓) R62: 47  $\Omega$  (yellow-violet-black).
- (✓) R63: 1000  $\Omega$  (brown-black-red).

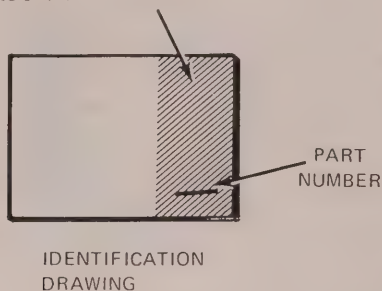


- (✓) R55: 100  $\Omega$  (brown-black-brown).
- (✓) R53: 4700  $\Omega$  (yellow-violet-red).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.



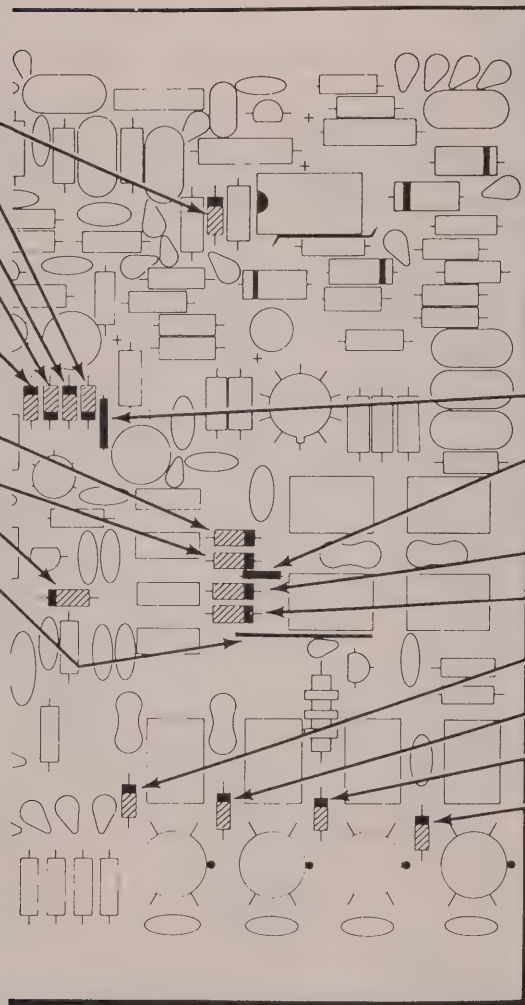
PICTORIAL 2-4

The steps performed in this Pictorial are in this area of the circuit board.



**START**

- ( ) D21: 1N458 diode (#56-24).
- Install four FH1100 diodes (#56-87).
- ( ) D12.
- ( ) D13.
- ( ) D15.
- ( ) D14.
- Install two 1N458 diodes (#56-24).
- ( ) D8.
- ( ) D7.
- ( ) ZD1: VR-9.1 zener diode (#56-19).
- ( ) 1-1/2" yellow wire at J.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

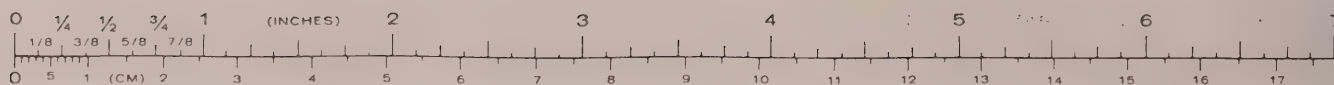


**CONTINUE**

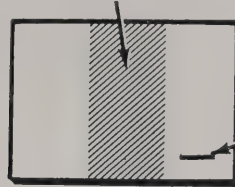
NOTE: Use the previously saved cut off resistor leads when you install the following jumper wires.

- ( ) 1" yellow wire at J.
- ( ) 1" yellow wire at J.
- Install six 1N458 diodes (#56-24).
- ( ) D6.
- ( ) D5.
- ( ) D1.
- ( ) D2.
- ( ) D3.
- ( ) D4.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-3



The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION  
DRAWING

**START**

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



Install eight 1N4149 diodes (#56-56).

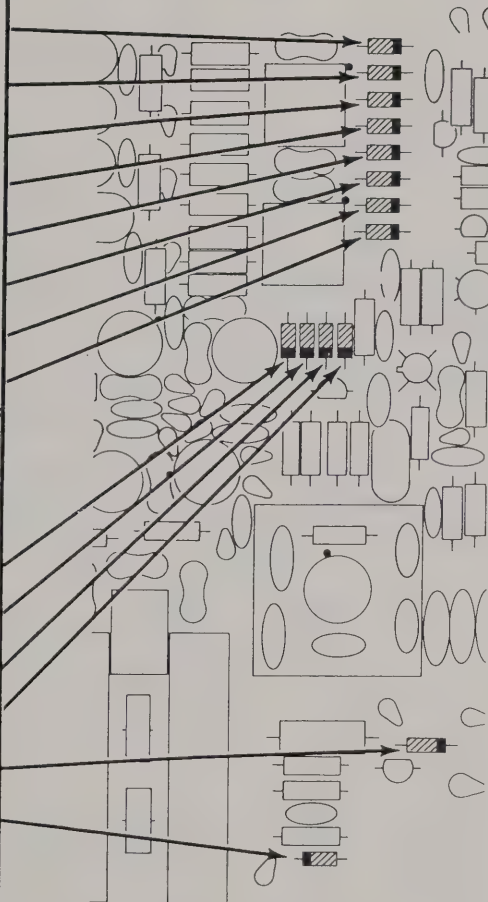
- (T) D23. ....
- (T) D22. ....
- (T) D24. ....
- (T) D25. ....
- (T) D26. ....
- (T) D29. ....
- (T) D27. ....
- (T) D28. ....

(T) Solder the leads to the foil and cut off the excess lead lengths.

Install six 1N458 diodes (#56-24).

- (T) D16. ....
- (T) D17. ....
- (T) D18. ....
- (T) D19. ....
- (T) D9. ....
- (T) D11. ....

(T) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 2-2

The steps performed in this Pictorial are in this area of the circuit board.

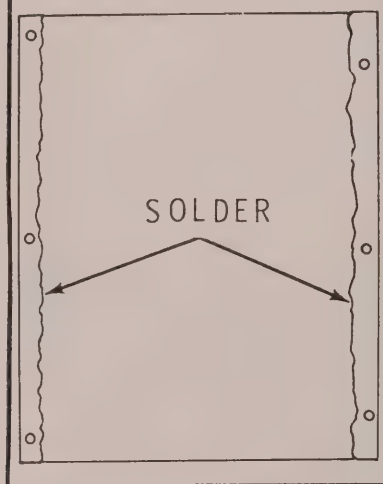


PART  
NUMBER

IDENTIFICATION  
DRAWING

## START

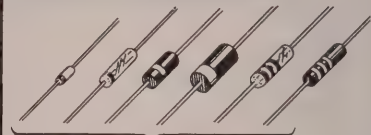
Position the main circuit board foil-side-up as shown below. Then apply a thin coating of solder along the indicated edges of the circuit board. This will assure a good ground connection when the circuit board is mounted later.



## CONTINUE

Position the main circuit board component side up as shown. Then perform the steps in the order listed.

**IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.**



BANDED END

BE SURE YOU INSTALL EACH DIODE SO ITS BANDED END IS POSITIONED AS SHOWN IN THE PICTORIAL.

Install eight 1N458 diodes (#56-24).

(✓) D34.

(✓) D33.

(✓) D32.

(✓) D31.

(✓) D35.

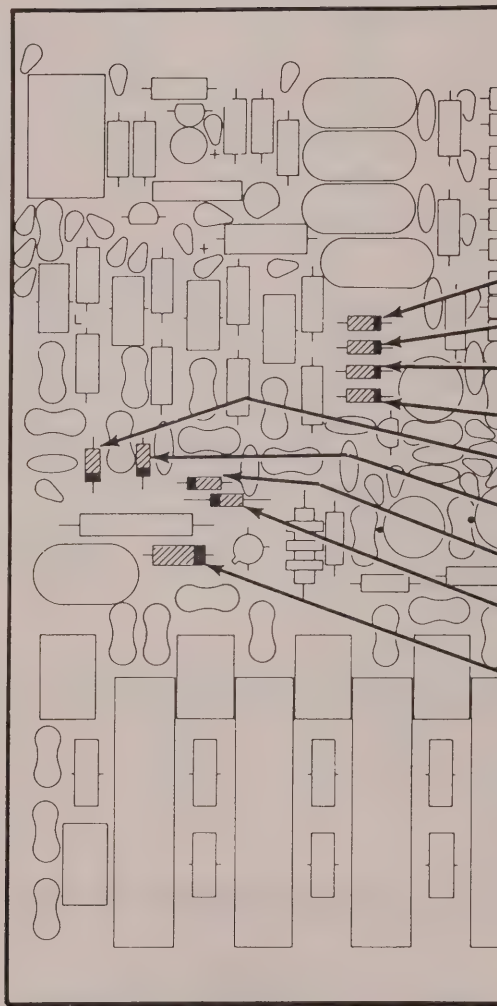
(✓) D36.

(✓) D37.

(✓) D38.

(✓) ZD2: VR-36 zener diode (#56-55).

(✓) Solder the leads to the foil and cut off the excess lead lengths.

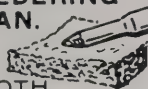


PICTORIAL 2-1

**START** ➡

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



NOTE: When you prepare the wires in the following steps, cut the wire to the length specified in the step and remove 1/4" of insulation from each end. Solder one end of each wire to the foil and cut off the excess wire lengths.

(✓) 2" yellow wire.

(✓) 2-3/4" yellow wire.

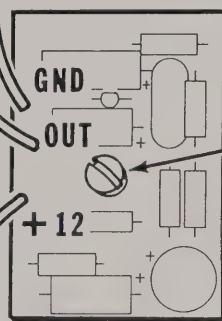
(✓) 3" yellow wire.

NOTE: The hole marked "IN" on the circuit board will be used later.

2-3/4" YEL

2" YEL

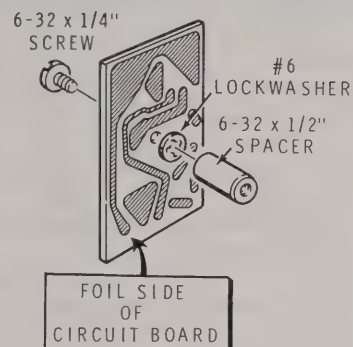
3" YEL



PICTORIAL 1-2

**CONTINUE** ➡

CAUTION: When you perform the next step, be sure the lockwasher does not touch the adjacent foil.



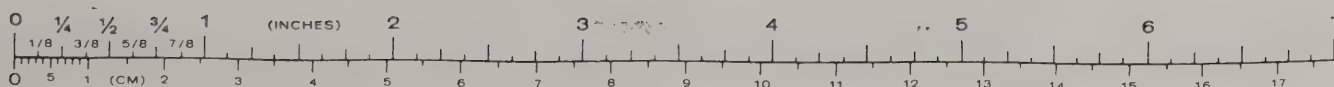
(✓) Mount a 6-32 x 1/2" spacer on the foil side of the circuit board as shown above.

**CIRCUIT BOARD CHECKOUT**

Carefully inspect the circuit board for the following conditions.

- (✓) Unsoldered connections.
- (✓) "Cold" solder connections.
- (✓) Solder bridges between foil patterns.
- (✓) Protruding leads which could touch together.
- (✓) Transistors for the proper type and installation.
- (✓) Electrolytic capacitors for the correct position of the positive (+) lead.

Set the circuit board aside until it is called for later.

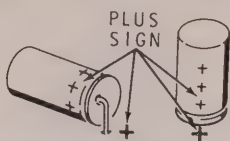
**FINISH**

## STEP-BY-STEP ASSEMBLY

**START** ➡

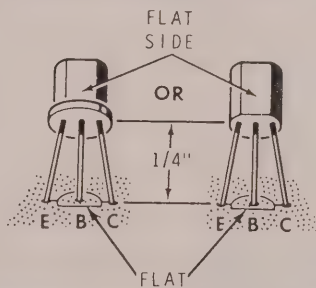
Position the AF Amplifier circuit board as shown. Then perform the steps in the order listed.

NOTE: When you install an electrolytic capacitor, always connect the lead at the positive (+) end of the capacitor to the positive (+) marked point on the circuit board.



(✓) C205: 25  $\mu$ F electrolytic.

NOTE: When you install the following transistor, line up the flat on the transistor with the outline of the flat on the circuit board. Then insert the E, B, and C leads of the transistor into the corresponding E, B, and C holes in the circuit board. Position the transistor 1/4" above the circuit board, solder the leads to the foil, and cut off the excess lead lengths.



(✓) Q201: MPS-A20 transistor (#417-801).

(✓) C204: 2  $\mu$ F electrolytic.

(✓) R201: 47  $\Omega$  (yellow-violet-black).

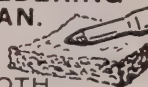
(✓) R202: 4700  $\Omega$  (yellow-violet-red).

(✓) C201: 2  $\mu$ F electrolytic.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN.

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.

**CONTINUE** ➡

(✓) R206: 220  $\Omega$  (red-red-brown).

(✓) C203: .1  $\mu$ F Mylar.

(✓) R204: 10 k $\Omega$  (brown-black-orange).

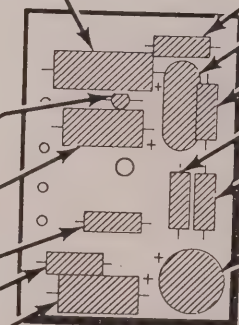
(✓) R205: 1000  $\Omega$  (brown-black-red).

(✓) R203: 47 k $\Omega$  (yellow-violet-orange).

(✓) C202: 100  $\mu$ F electrolytic.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

(✓) Save two of the cut off resistor leads. They will be used when you install jumper wires on the main circuit board.



PICTORIAL 1-1

KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

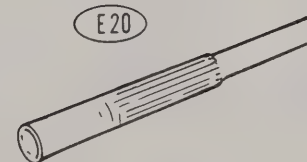
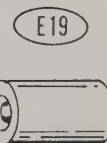
## Miscellaneous (cont'd.)

E15	(✓)	3	Cable tie	354-5
E16	(✓)	4	6-32 x 1/4" screw	250-56
E17	(✓)	3	6-32 nut	252-3
E18	(✓)	4	#6 lockwasher	254-1
E19	(✓)	1	6-32 x 1/2" spacer	255-23



## PARTS FROM FINAL PACK

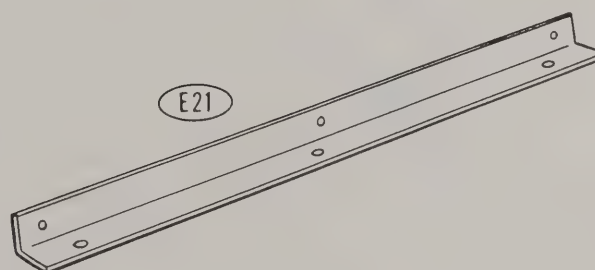
E20	(✓)	1	Nut starter	490-5
E21	(✓)	1	Angle bracket	204-1844
	(✓)	11'	Yellow wire	344-54
	(✓)	5'	5-wire cable	347-39
	(✓)	6'	Shielded cable	343-15
	(✓)	1	Main circuit board	85-1748-5
	(✓)	1	AF Amplifier circuit board	85-1677-1
	(✓)		Solder	



## PRINTED MATERIAL

NOTE: Be sure you refer to the numbers on the blue and white label in any communications you may have about this kit with Heath Company. You may want to write the model and series numbers in the sample label for future convenience.

(✓)	1	Blue and white label	391-34
(✓)	1	Parts Order Form	597-260
(✓)	1	Kit Builders Guide	597-308
(✓)	1	Manual (See front cover for part number.)	
( )	1	Technical letter	597-1412



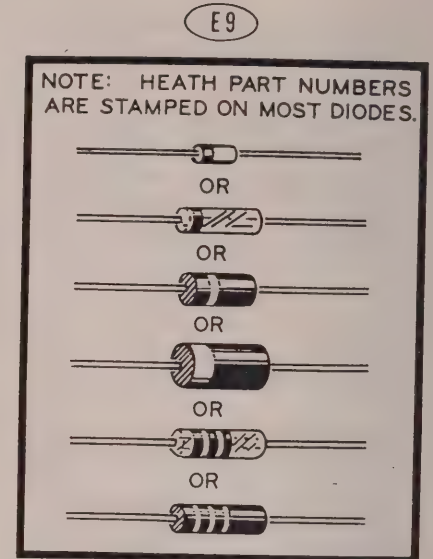
391-34

HEATH	
MODEL	SERIES NO.
HW-8	09843

KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

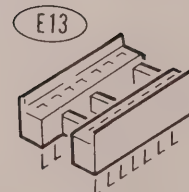
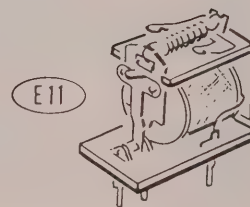
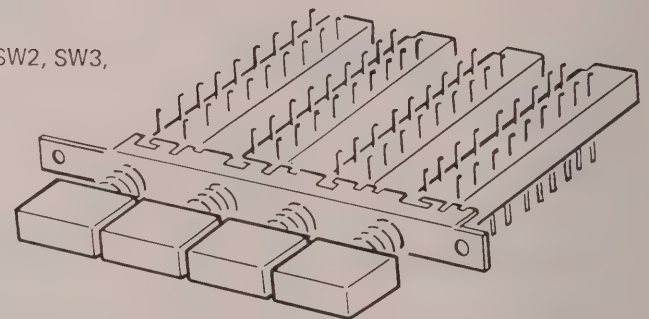
## DIODES

E9	(✓)	1	VR-9.1 zener	56-19	ZD1
E9	(✓)	1	VR-36 zener	56-55	ZD2
E9	(✓)	4	FH1100	56-87	D12, D13, D14, D15
E9	(✓)	23	1N458	56-24	D1, D2, D3, D4, D5, D6, D7, D8, D9, D11, D16, D17, D18, D19, D21, D31, D32, D33, D34, D35, D36, D37, D38
E9	(✓)	8	1N4149	56-56	D22, D23, D24, D25, D26, D27, D28, D29



## MISCELLANEOUS

E10	(✓)	1	Pushbutton switch assembly	64-775	SW1, SW2, SW3, SW4
E11	(✓)	1	Relay	69-47	RY1
E12	(✓)	1	Heat sink	215-45	
E13	(✓)	1	IC socket	434-298	
E14	(✓)	1	Ferrite bead	475-10	



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
D16 (✓)	1	1000 $\Omega$ control	10-936	R77
D16 (✓)	1	50 k $\Omega$ control	10-222	R68

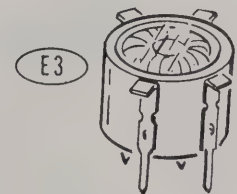


CAUTION: Do not remove the coils or chokes from their envelopes until they are called for in a step.

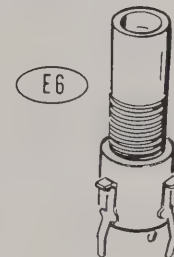
E1 (✓)	4	1.3 $\mu$ H toroid coil	40-1800	L8, L25, L33, L34
E1 (✓)	2	1.8 $\mu$ H toroid coil	40-1792	L7, L24
E1 (✓)	2	2.5 $\mu$ H toroid coil	40-1609	L31, L32
E1 (✓)	2	4.2 $\mu$ H toroid coil	40-1798	L6, L23
E1 (✓)	2	7.0 $\mu$ H toroid coil	40-1726	L28, L29
E1 (✓)	1	9.0 $\mu$ H toroid coil	40-1797	L22
E1 (✓)	2	15.5 $\mu$ H toroid coil	40-1882	L5, L26
E1 (✓)	1	27.5 $\mu$ H toroid coil	40-1791	L27
E2 (✓)	2	15.0 $\mu$ H toroid coil	40-1050	L11, L12
E3 (✓)	2	1.8 $\mu$ H toroid coil	40-1788	L3, L4
E3 (✓)	1	4.7 $\mu$ H toroid coil	40-1787	L2
E3 (✓)	1	13.0 $\mu$ H toroid coil	40-1786	L1
E4 (✓)	1	.83 $\mu$ H coil	40-1804	L19/L21
E4 (✓)	1	1.47 $\mu$ H coil	40-1803	L17/L18
E5 (✓)	1	4.0 $\mu$ H coil	40-1795	L14
E5 (✓)	2	1.3 $\mu$ H coil	40-1796	L15, L16
E5 (✓)	1	8.0 $\mu$ H coil	40-1794	L13
E6 (✓)	1	5.0 $\mu$ H coil	40-1802	L9
E7 (✓)	1	26.0 $\mu$ H choke	45-62	RFC3
E8 (✓)	2	350 $\mu$ H choke	45-82	RFC1, RFC2



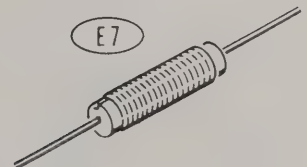
E2



E5



E7



E8

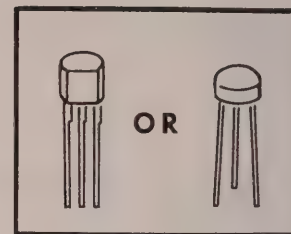


KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
------------	------	-------------	-------------	--------------------------

### Transistors-Integrated Circuits (IC's)

D10 (✓)	2	MPS6521 transistor	417-172	Q6, Q8
D11 (✓)	1	2N4427 transistor	417-880	Q9
D12 (✓)	1	X29A829 transistor	417-201	Q13
D13 ( )	1	MC1496G IC (inte- grated circuit)	442-96	IC1
D14 (✓)	1	LM3900	442-71	IC2

D10



### CRYSTALS

D15 (✓)	1	12.395 MHz	404-207	Y1
D15 (✓)	1	15.895 MHz	404-208	Y2
D15 (✓)	1	22.895 MHz	404-209	Y3
D15 (✓)	1	29.895 MHz	404-210	Y4

D11



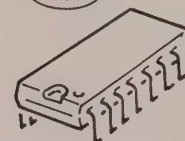
D12



D13



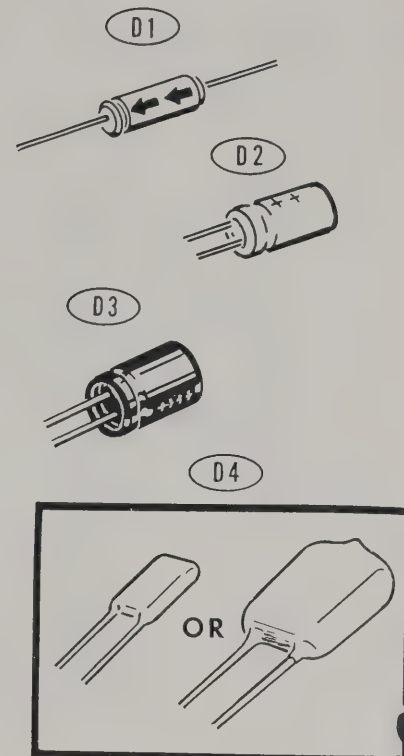
D14



D15



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
<b>Other Capacitors</b>				
D1 (✓)	5	2 $\mu$ F electrolytic	25-123	C38, C42, C91, C201, C204 C205
D1 (✓)	1	25 $\mu$ F electrolytic	25-96	C33, C92
D2 (✓)	2	10 $\mu$ F electrolytic	25-115	C32, C41, C202
D3 (✓)	3	100 $\mu$ F electrolytic	25-117	C109
D4 (✓)	1	.022 $\mu$ F Mylar	27-63	C26, C27, C31, C39, C74, C111, C112, C113, C203 C93
D4 (✓)	9	.1 $\mu$ F Mylar	27-47	C36, C37 C34, C35
D4 (✓)	1	.47 $\mu$ F Mylar	27-86	C53
D5 (✓)	2	1000 pF polystyrene	29-5	C6, C16, C19
D5 (✓)	2	1800 pF, (1.8n) poly- styrene	29-4	C3, C7, C9, C22, C24, C95, C99, C103, C106
D6 (✓)	1	4.7 pF ceramic	21-29	
D7 (✓)	3	4 to 40 pF trimmer	31-54	
D7 (✓)	9	8 to 60 pF trimmer	31-52	



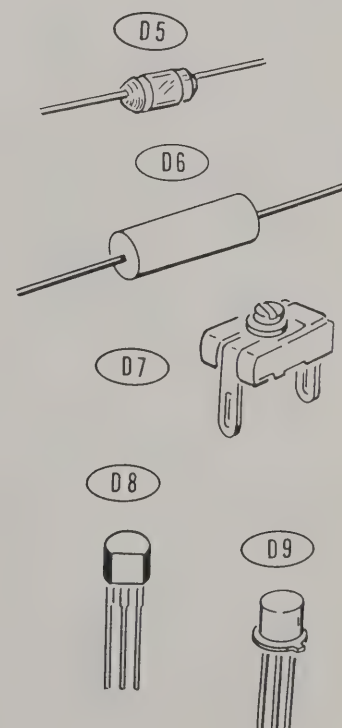
## TRANSISTORS — INTEGRATED CIRCUITS (IC's)

NOTE: Transistors and IC's are marked for identification in one of the following ways:

1. Part number.
2. Type number. (On integrated circuits this refers only to the numbers; the letters may be different or missing.)
3. Part number and type number.
4. Part number and a type number other than the one listed.

D8 (✓)	2	MPF105 transistor (JFET)	417-169	Q1, Q2
D8 (✓)	6	MPS-A20 transistor	417-801	Q3, Q5, Q7, Q12, Q14, Q201
D8 (✓)	1	S2091 transistor	417-116	Q11
D9 (✓)	1	40673 transistor (MFET)	417-240	Q4

(M) 417-240 825

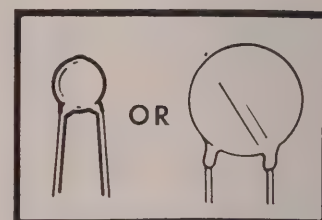


KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
<b>CAPACITORS</b>				
<b>Mica</b>				
B1	(✓) 1	24 pF	20-77	C123
B1	(✓) 5	47 pF	20-101	C71, C87, C88, C15, C121
B1	(✓) 2	68 pF	20-76	C1, C4
B1	(✓) 2	75 pF	20-110	C18, C104
B1	(✓) 6	100 pF	20-102	C61, C68, C98, C101, C107, C116
B1	(✓) 3	130 pF	20-104	C84, C85, C118
B1	(✓) 3	150 pF	20-103	C66, C96, C108
B1	(✓) 1	200 pF	20-108	C105
B1	(✓) 2	230 pF	20-111	C64, C82
B1	(✓) 2	270 pF	20-114	C94, C114
B1	(✓) 1	330 pF	20-139	C78
B1	(✓) 1	400 pF	20-116	C102
B1	(✓) 1	470 pF	20-128	C81
B1	(✓) 2	680 pF	20-107	C77, C97
<b>Disc</b>				
C1	(✓) 4	3.3 pF	21-33	C12, C54, C73, C127
C1	(✓) 1	5 pF	21-157	C125
C1	(✓) 1	6 pF	21-169	C55
C1	(✓) 1	6.8 pF	21-703	C47
C1	(✓) 2	10 pF	21-3	C25, C126
C1	(✓) 1	27 pF	21-716	C48
C1	(✓) 2	56 pF	21-160	C49, C51
C1	(✓) 3	510 pF	21-191	C44, C45, C46
C1	(✓) 34	.05 $\mu$ F	21-143	C2, C5, C8, C11, C13, C14, C17, C21, C23, C28, C29, C43, C52, C56, C57, C58, C59, C62, C63, C65, C67, C69, C72, C75, C76, C79, C83, C86, C89, C115, C117, C119, C122, C128

B1



C1



KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
<b>RESISTORS (cont'd.)</b>				
A1 (✓)	19	1000 $\Omega$ (brown-black-red)	1-9	R1, R2, R3, R4, R7, R8, R12, R36, R58, R61, R63, R65, R69, R76, R78, R82, R85, R88, R205
A1 (✓)	1	1200 $\Omega$ (brown-red-red)	1-10	R9
A1 (✓)	2	2700 $\Omega$ (red-violet-red)	1-13	R16, R17
A1 (✓)	1	3300 $\Omega$ (orange-orange-red)	1-14	R92
A1 (✓)	5	4700 $\Omega$ (yellow-violet-red)	1-16	R53, R64, R66, R67, R202
A1 (✓)	4	6800 $\Omega$ (blue-gray-red)	1-19	R79, R83, R86, R89
A1 (✓)	4	10 k $\Omega$ (brown-black-orange)	1-20	R15, R50, R71, R204
A1 (✓)	4	22 k $\Omega$ (red-red-orange)	1-22	R29, R37, R52, R95
A1 (✓)	6	47 k $\Omega$ (yellow-violet-orange)	1-25	R19, R44, R47, R48, R75, R203
A1 (✓)	2	68 k $\Omega$ (blue-gray-orange)	1-60	R38, R94
A1 (✓)	2	82 k $\Omega$ (gray-red-orange)	1-102	R21, R24
A1 (✓)	7	100 k $\Omega$ (brown-black-yellow)	1-26	R5, R43, R45, R81, R84, R87, R91
A1 (✓)	2	470 k $\Omega$ (yellow-violet-yellow)	1-33	R22, R23
A1 (✓)	3	1 M $\Omega$ (brown-black-green)	1-35	R25, R27, R32
A1 (✓)	1	2.2 M $\Omega$ (red-red-green)	1-37	R26
A1 (✓)	1	3.3 M $\Omega$ (orange-orange-green)	1-38	R72
A1 (✓)	2	10 M $\Omega$ (brown-black-blue)	1-40	R73, R74

A1



# CIRCUIT BOARD

## PARTS LIST

Open the container marked PTS #1 and check each part against the following list. You will also be instructed to remove some of the other parts that are left in the carton. These parts will be referred to as the "Parts From Final Pack." Make a check (✓) in the space provided as you identify each part. The illustrations show what the part looks like. Only the hardware is shown actual size.

Some parts are packaged in containers with the part number marked on the outside. Except for the initial parts check, keep these parts in their containers so they can be easily identified when they are called for in the assembly steps.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with the kit. If one is not available, see "Replacement Parts" inside the rear cover of this Manual. Your Warranty is located inside the front cover. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
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### RESISTORS

NOTE: Resistors may be packed in more than one envelope. All resistors are 1/2-watt, 10% tolerance (silver fourth band) unless otherwise stated.

A1	(✓)	7	47 $\Omega$ (yellow-violet-black)	1-1	R13, R31, R54, R57, R59, R62, R201
A1	(✓)	10	100 $\Omega$ (brown-black-brown)	1-3	R14, R18, R28, R39, R41, R42, R46, R51, R55, R96
A1	(✓)	1	220 $\Omega$ (red-red-brown)	1-45	R206
A1	(✓)	2	270 $\Omega$ (red-violet-brown)	1-42	R6, R49
A1	(✓)	5	470 $\Omega$ (yellow-violet-brown)	1-6	R33, R34, R35, R56 R93
A1	(✓)	1	820 $\Omega$ (gray-red-brown)	1-8	R11

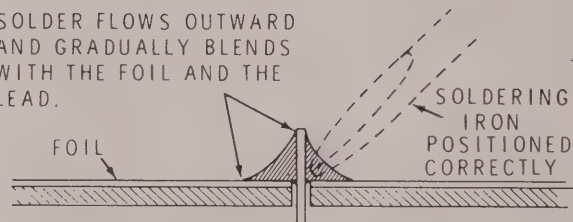
A1





### A GOOD SOLDER CONNECTION

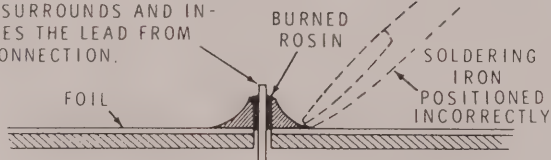
SOLDER FLOWS OUTWARD AND GRADUALLY BLENDS WITH THE FOIL AND THE LEAD.



Heat both the lead and the circuit board foil at the same time. The solder will flow onto the lead and the foil evenly and will then make a good electrical connection between the lead and the foil.

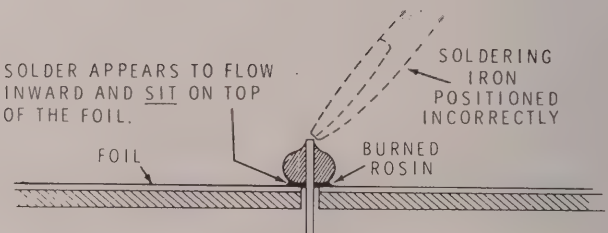
### BAD SOLDER CONNECTIONS

SOLDER DOES NOT FLOW ONTO LEAD. A DARK ROSIN BEAD SURROUNDS AND INSULATES THE LEAD FROM THE CONNECTION.



When the lead is not heated sufficiently, the solder will not flow onto the lead as shown above. Reheat the connection and, if necessary, apply a small amount of additional solder to obtain a connection as shown under "A Good Solder Connection."

SOLDER APPEARS TO FLOW INWARD AND SIT ON TOP OF THE FOIL.



When the foil is not heated sufficiently, the solder will blob on the circuit board as shown above. Reheat the connection and, if necessary, apply a small amount of additional solder to obtain a connection as shown under "A Good Solder Connection."

## SOLDERING INSTRUCTIONS

Poor soldering accounts for about 90% of all kit building problems. The following photographs show examples of the types of bad solder connections that are the most common cause of trouble. If you locate any of these bad solder connections in your kit, correct them as instructed. Study this section carefully before you begin to assemble your kit.



In this case, the solder was applied to the lead but did not flow onto the foil. To correct, reheat the connection.



Here, solder has flowed along a lead and bridged to another foil. To correct, hold the circuit board above the soldering iron and reheat the solder. As the solder melts, it will flow down the iron. Then cut off the excess lead length. **PROTECT YOUR EYES.**



Here, hot solder has been dropped onto the foil and the solder connected or bridged (or crossed) three foils. To correct, hold the circuit board above the soldering iron and reheat the solder. As the solder melts, it will flow down the iron. **PROTECT YOUR EYES.**

**NOTE:** Solder that bridges two connections on the **SAME FOIL** is alright and should not be corrected.

Keep the soldering iron tip clean by wiping it from time to time with a damp sponge or cloth.

# ASSEMBLY NOTES

A separate "Illustration Booklet" contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. The illustrations are arranged in Pictorial number sequence. Place the Booklet in a convenient location and keep it with the Assembly Manual.

Each circuit part has its own component number (R2, C4, L3, etc.). Use these numbers when you want to identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:

- In the parts list,
- At the beginning of each step where a component is installed,
- In some illustrations,

- In the Schematic,
- In the sections at the rear of the Manual.

Before you start to assemble this kit, read the wiring, soldering, and step-by-step assembly information in the "Kit Builders Guide."

Resistors are identified by their value in ohms ( $\Omega$ ), kilohms ( $k\Omega$ ) or megohms ( $M\Omega$ ) and by color code.

Capacitors are identified by their type (disc, Mylar\*, electrolytic, tuning, trimmer, or polystyrene), and capacitance value in  $\mu F$  or pF.

\*Registered DuPont Trademark.

## NOTES:

- 1 If you use a keyer such as the Heathkit Model HD-1410, wire jack BB as directed in steps 1, 2, and 3, as shown in inset drawing #1 on Pictorial 4-2. Then disregard steps 4, 5, and 6.
- 2 If you intend to use a Heathkit Model HD-10 Keyer, disregard steps 1, 2, and 3. Then wire jack BB as directed in steps 4, 5, and 6, and as shown in inset drawing #2 on Pictorial 4-2.
- 3 You can use a "straight" key with both wiring options.
  1. 3-1/2" yellow wire from hole W (S-1) to jack BB lug 2 (NS).
  2. 7" yellow wire from hole AA (S-1) to jack BB lug 2 (S-2).
  3. 4" yellow wire from hole Y (S-1) to jack BB lug 1 (S-1).

— OR —

  4. 3-1/2" yellow wire from hole W (S-1) to jack BB lug 1 (NS).
  5. 7" yellow wire from hole AA (S-1) to jack BB lug 1 (S-2).
  6. 4" yellow wire from hole Y (S-1) to jack BB lug 2 (S-1).
- Refer to the inset drawing on Pictorial 4-2 and install a female connector pin (#432-73) on one end of a 4" yellow wire.
- Insert the connector pin into chassis connector BC hole 3. Push in on the pin until it locks in place in the chassis connector.
- Connect the free end of the 4" yellow wire to circuit board hole Z (S-1).
- Connect a 3-1/2" yellow wire from circuit board hole BB (S-1) to jack BD lug 2 (NS).
- Connect a 2" yellow wire from hole DD (S-1) to jack BD lug 1 (NS).

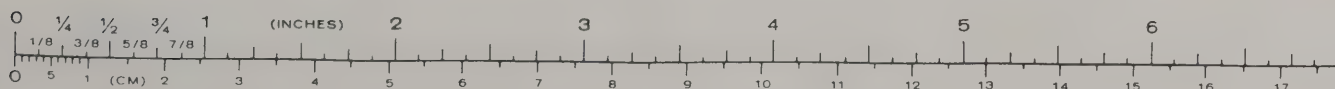
## MOUNTING PANEL/CIRCUIT BOARD ASSEMBLY

Refer to Pictorial 4-3 in the Illustration Booklet for the following steps.

- 1 Refer to inset #1 on the Pictorial and press plastic chassis nuts into both holes at CA in the right side of the chassis.
- 2 In the same manner, press plastic chassis nuts into both holes at DA in the other side of the chassis.
- 3 Install 6-32 x 3/8" hardware into chassis holes AB and AD in the front of the chassis.

CAUTION: When you perform the following steps, be sure you position the front edge of the circuit board ABOVE the flange on the front of the chassis as shown in the inset drawing on the Pictorial.

- 4 Spring the chassis sides outward slightly; then install the panel/circuit board assembly inside the chassis. Be careful you do not pinch any wires when you insert the knobs of the pushbutton switch assembly through the opening in the front of the chassis.
- 5 Check the operation of each pushbutton switch. Reposition any wires that interfere with proper operation.
- 6 Be sure the front edge of the circuit board is above the chassis flange; then loosely secure the rear panel to the chassis with #6 x 1/4" sheet metal screws at the four indicated locations.
- 7 Carefully push the cables and wires away from the front of the chassis so the mounting holes in the front edge of the circuit board are exposed.
- 8 Secure the front edge of the circuit board to the flange with 6-32 x 1/4" hardware. Then tighten the four screws in the rear panel.

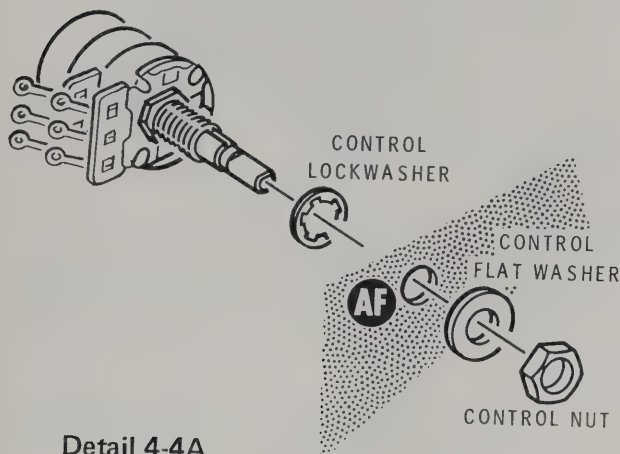




## CHASSIS PARTS MOUNTING AND WIRING

Refer to Pictorial 4-4 in the Illustration Booklet for the following steps.

- (✓) R301, R302, SW301: Refer to Detail 4-4A and install a control-with-switch (#14-17) at AF. Position the control as shown in the Pictorial.



Detail 4-4A

NOTE: Inset drawing #1 on Pictorial 4-4 is a "blow-up" of the wiring of control AF. Refer to both inset drawing #1 and Pictorial 4-4 when you perform the following ten steps.

Connect the black, green, and white wires of the cable marked X on the Pictorial to control AF as follows:

1. (✓) White to lug 6 (S-1).
2. (✓) Green to lug 5 (S-1).
3. (✓) Black to lug 4 (NS).

NOTE: Protruding from cable-tie F are the free ends of two shielded cables. Connect these cables as directed in the following steps.

4. (✓) At the free end of the shielded cable coming from cable-tie F and switch SW4, connect the inner lead to control AF lug 2 (S-1) and the shield lead to lug 1 (NS).
5. (✓) At the free end of the other shielded cable coming from cable-tie F, connect the inner lead to control AF lug 3 (S-1) and the shield lead to lug 1 (NS).

6. ( ) Remove all of the insulation from a 2" length of yellow wire.
7. ( ) Insert one end of this bare wire through control AF lug 1 (NS); then on to lug 4 (NS).

NOTE: When a wire passes through a connection and goes to another point, as in the preceding step, it will count as two wires in the solder instruction, one entering and one leaving the connection. When you solder this type connection, be sure you use enough solder and heat to properly solder the "through wire" and all other wires at the connection.

8. (✓) Solder all of the wires at control AF lug 1 (S-4). Position the free end of the wire out of the way for connection later.
9. (✓) Cut both leads of a .47  $\mu$ F Mylar capacitor to 3/4".
10. (✓) C305: Connect the prepared .47  $\mu$ F capacitor between control AF lugs 4 (S-3) and 8 (NS).

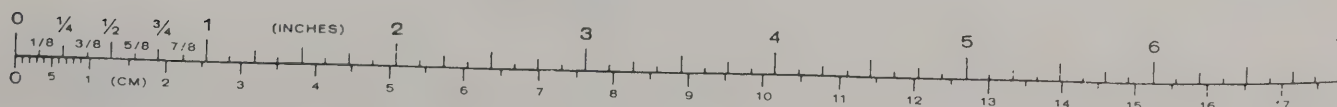
- (✓) Refer to inset drawing #2 on the Pictorial and install a female connector pin (#432-73) on one end of an 8-1/2" yellow wire.

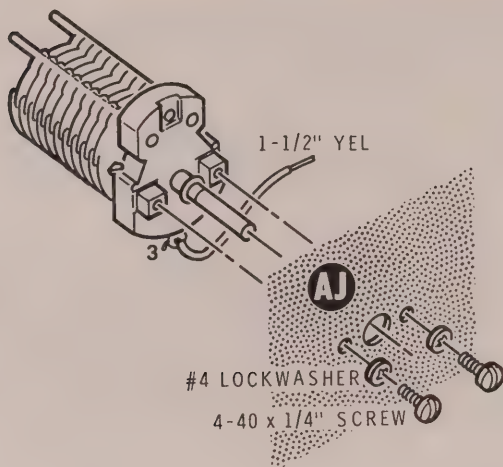
- (✓) Insert the connector pin into chassis connector BC hole 6. Push in on the pin until it locks in place in the connector.

- (✓) Connect the other end of the wire to control AF lug 7 (S-1).

- (✓) Connect a 6" yellow wire from circuit board hole E to control AF lug 8 (S-2).

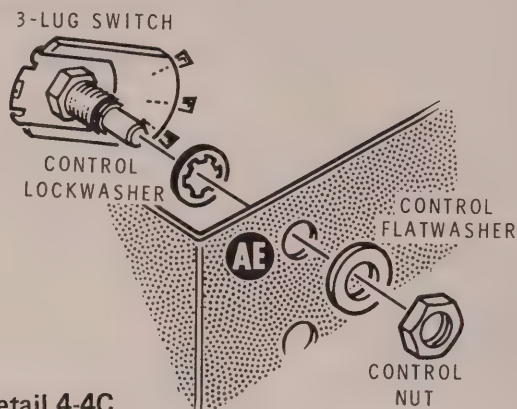
- (✓) Refer to Detail 4-4B and connect a 1-1/2" yellow wire to lug 3 (S-1) of the loading capacitor (#26-154) as shown.





Detail 4-4B

- ✓ C303: Refer to Detail 4-4B and install the prepared loading capacitor at AJ with 4-40 x 1/4" hardware. Position the capacitor as shown in the Pictorial. Also, be sure no wires or cables are caught under the capacitor.
- ✓ Connect the free end of the 1-1/2" yellow wire coming from lug 3 of this capacitor to switch SW2 pin 11 (S-1). NOTE: Be sure you position this wire so that, when the movable plates of the capacitor are turned, they will not hit the wire.
- ✓ Locate the shielded cable coming from cable-tie E. Then cut the shield lead off the free end of the cable.
- ✓ Connect the inner lead of this cable to capacitor AJ lug 2 (S-1).

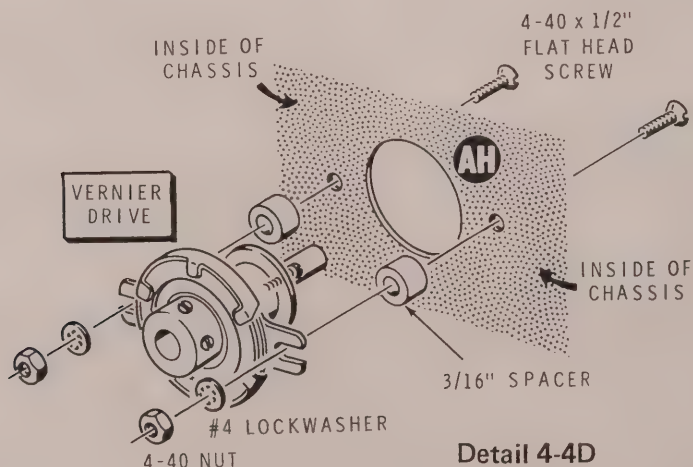


Detail 4-4C

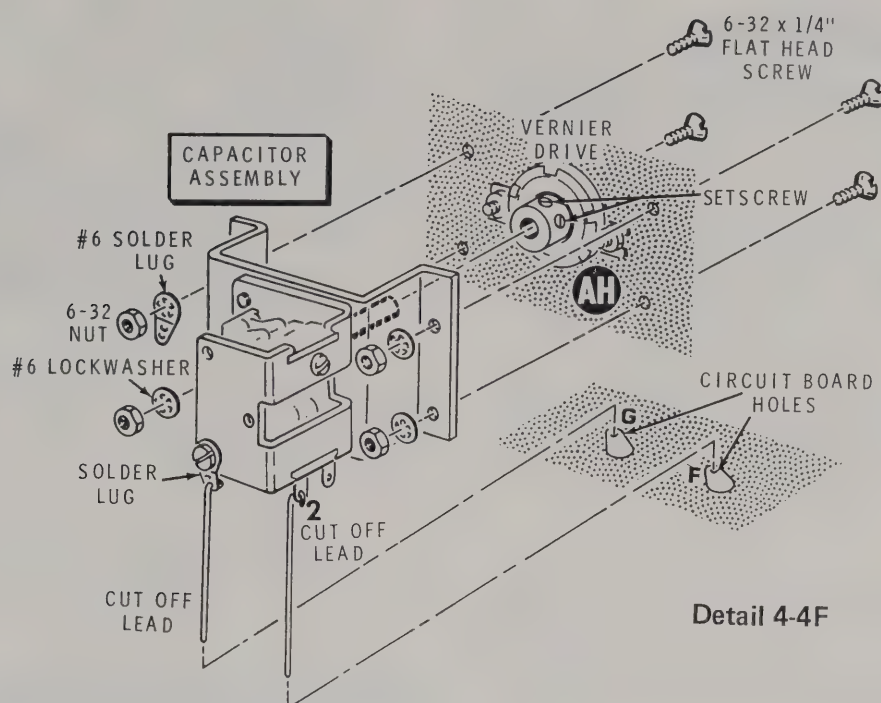
- ✓ SW302: Refer to Detail 4-4C and install a 3-lug rotary switch (#63-3) at AE. Position the switch so the space between lugs 1 and 2 is toward the screw at AD, as shown in the Pictorial.

Connect the 3-wire cable coming from cable-tie F (cable marked Y on the Pictorial) to switch AE as follows:

- ✓ Red to lug 3 (S-1).
- ✓ White to lug 2 (S-1).
- ✓ Black to lug 1 (S-1).
- ✓ Carefully press the wires down out of the way under the body of the switch.
- ✓ Refer to Detail 4-4D and mount the vernier drive (#100-1608) at AH with 4-40 x 1/2" hardware and 3/16" spacers. Be sure to center the vernier drive in the opening.



Detail 4-4D



**CAUTION:** Keep the rotor (movable plates) of the capacitor closed while you perform the following steps.

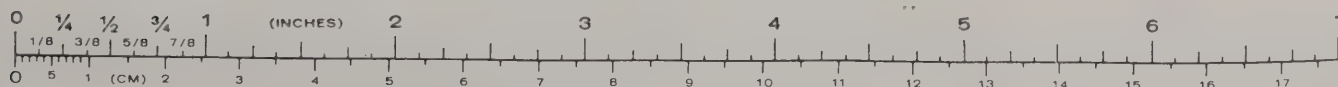
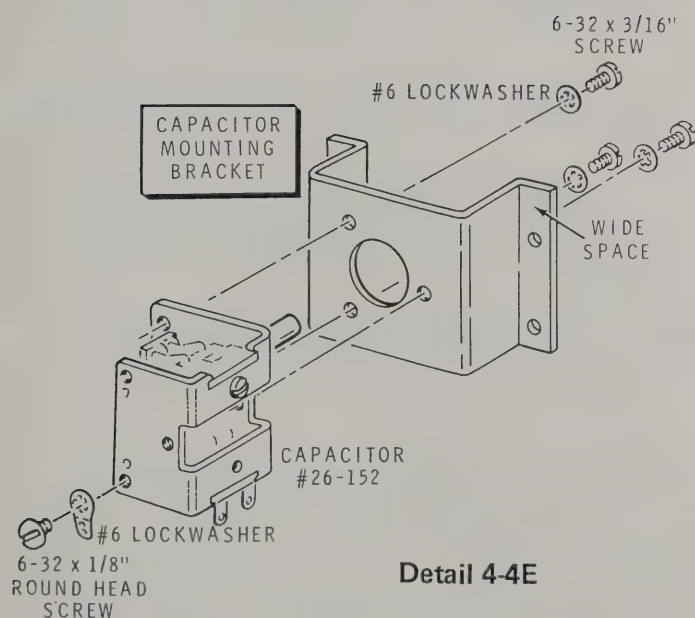
(✓) C302A/B: Refer to Detail 4-4E and mount the VFO tuning capacitor (#26-152) on the capacitor mounting bracket with 6-32 x 3/16" hardware. **CAUTION:** Be sure you position the bracket so its wide space is located as shown.

(✓) Mount a #6 solder lug on the capacitor frame with a 6-32 x 1/8" round head screw. Position the solder lug as shown in the Detail.

( ) Remove the insulation from two 1-1/2" yellow wires.

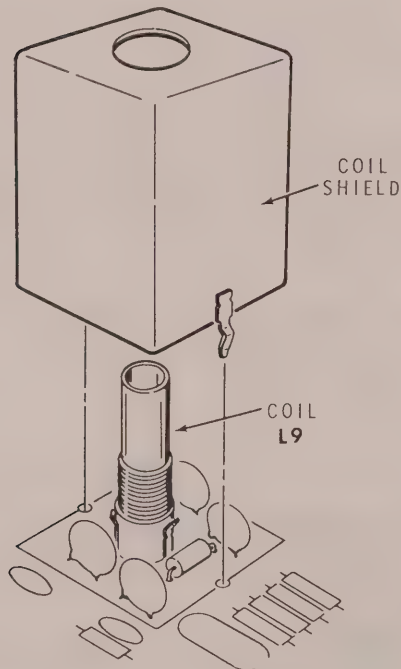
(✓) Refer to Detail 4-4F and connect a 1-1/2" bare wire to the solder lug on the capacitor assembly as shown (S-1).

(✓) In a similar manner, connect a 1-1/2" bare wire to lug 2 on the capacitor (S-1).

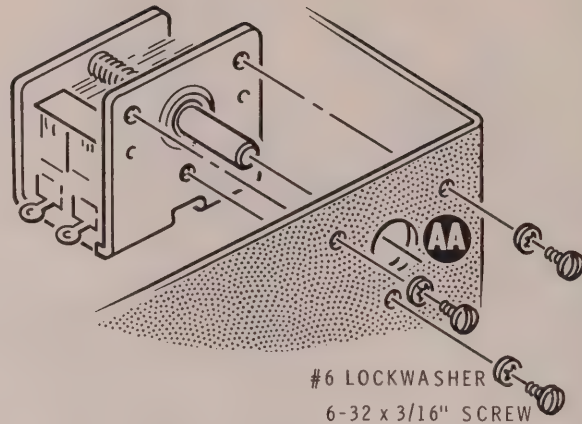


# NOTES:

1. You will guide the bare wires on the capacitor assembly into holes in the circuit board when you mount the assembly in the following steps. At the same time, you will insert the shaft of the capacitor into the hole in the vernier drive.
2. Loosen the setscrews in the vernier drive just enough to allow the capacitor shaft to enter the hole in the drive. CAUTION: Be sure you do not lose the setscrews.
3. Guide the two bare wires on the capacitor assembly into circuit board holes G and F, at the same time, insert the capacitor shaft into the hole in the vernier drive. See Pictorial 4-4 and Detail 4-4F.
4. Refer to Detail 4-4F and mount the capacitor assembly at AH with 6-32 x 1/4" flat head hardware. NOTE: Use a #6 solder lug at AG instead of a lockwasher. Also, be sure none of the cables are pinched under the assembly.



Detail 4-4G

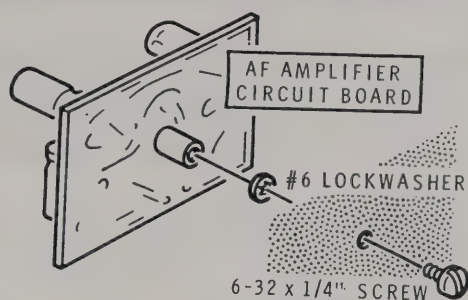


Detail 4-4H

5. Connect the free end of the bare wire coming from control AF lug 1 to solder lug AG (S-1).
6. Locate the coil shield (#206-502). Then refer to Detail 4-4G and install the shield over coil L9 on the circuit board.

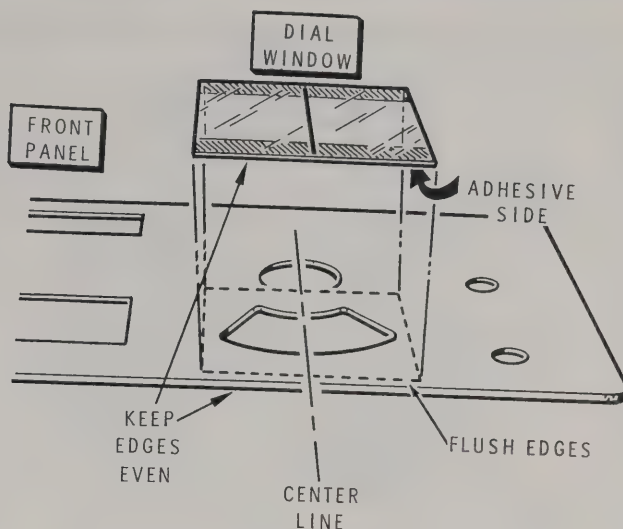
NOTE: Before you solder the wires in the next step, be sure you pull them as far as possible through the circuit board holes.

7. Turn the Transceiver over and solder the shield lugs and the two bare wires protruding from the circuit board to the foil. Then cut off ONLY the excess wire lengths.
8. C301A/B: Refer to Detail 4-4H and install a 2-section variable capacitor (#26-151) at AA with 6-32 x 3/16" hardware.
9. Connect a 2-1/2" yellow wire from coil L1 lug 4 (S-1) to capacitor AA lug 1 (S-1).
10. Connect a 3" yellow wire from circuit board hole A (S-1) to capacitor AA lug 2 (S-1).



Detail 4-4J

NOTE: In the next step, you will connect the free end of "the green wire," at the lower left corner of the chassis, to the circuit board of the previously set-aside AF amplifier assembly.



Detail 4-5A

## FRONT PANEL MOUNTING

( ) Connect the free end of the green wire (coming from 3-wire cable X) to the hole marked IN on the AF amplifier circuit board (S-1).

( ) Refer to Detail 4-4J and mount the AF amplifier assembly at CB with 6-32 x 1/4" hardware. Position the assembly as shown in the Pictorial.

Refer to Pictorial 4-4 for the following steps.

Connect the free end of the wires coming from the AF amplifier assembly as follows:

( ) Wire from hole +12 to main circuit board hole VA (S-1).

( ) Wire from hole GND to jack BD lug 1 (S-2).

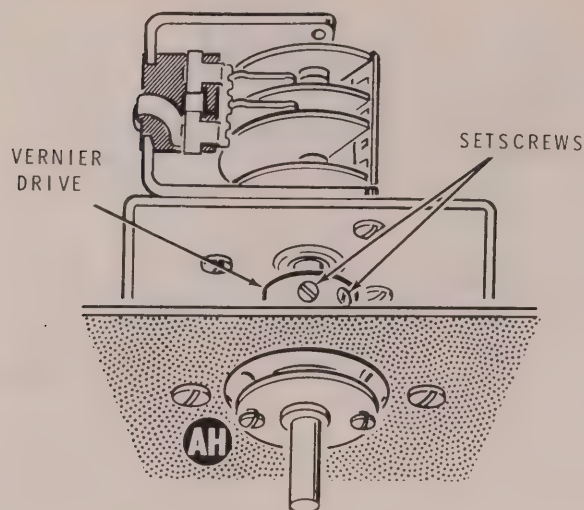
( ) Wire from hole OUT to jack BD lug 2 (S-2).

( ) Refer to Detail 4-5A and mark the inside of the front panel as shown by the center line through hole AH.

( ) Remove the lengths of tape from the dial window (#446-602-1). Position the black line on the window over the line marked on the panel. Position the edge of the window even with the edge of the panel as shown. Then press the window firmly onto the panel. NOTE: Be careful you do not scratch the window.

Refer to Pictorial 4-5 in the Illustration Booklet for the following steps.

( ) Refer to Detail 4-5B and turn the shaft of vernier drive AH until its setscrews are positioned as shown.



Detail 4-5B

- (✓) Temporarily remove the two brass screws from the front of the vernier drive.
- (✓) Place the dial on the vernier drive so the scale of the dial is toward the right as shown in the Pictorial. Then secure the dial to the vernier drive with the previously removed brass screws. CAUTION: Do not scratch the face of the dial.
- (✓) Place the front panel on the chassis. Then secure it with control nuts at AE and AF. Be careful you do not scratch the panel when you tighten the control nuts.

## INSTALLING KNOBS

- (✓) Start 6-32 x 1/8" setscrews in the four small knobs.
- (✓) Start an 8-32 x 3/8" setscrew into the large knob.
- (✓) Turn the outer and inner shafts of control AF counterclockwise as far as they will go. NOTE: Be sure you turn the inner shaft until the switch clicks off.
- (✓) With the tab of the silver knob in the MIN position, press the knob onto the slotted outer shaft of control AF.

- (✓) Place the split bushing on the inner shaft of control AF; then press a small knob on the bushing. Turn the knob until its color dot is lined up with the word OFF on the panel and securely tighten the knob setscrew.
- (✓) Turn the shaft of capacitor AA fully counterclockwise and place a small knob on its shaft. Line up the color dot on the knob with the left scale-mark on the panel; then tighten the setscrew.
- (✓) Turn the shaft of switch AE fully clockwise and place a small knob on its shaft. Line up the color dot with the NARROW line on the panel and tighten the setscrew.
- (✓) Turn the shaft of capacitor AJ until the capacitor plates are fully meshed; then place a small knob on the shaft. Line up the color dot on the knob with the left scale-mark on the panel and tighten the setscrew.

- (✓) Place the large knob on the shaft of vernier drive AH and tighten the setscrew. NOTE: Be sure the knob turns freely and does not rub against the panel.

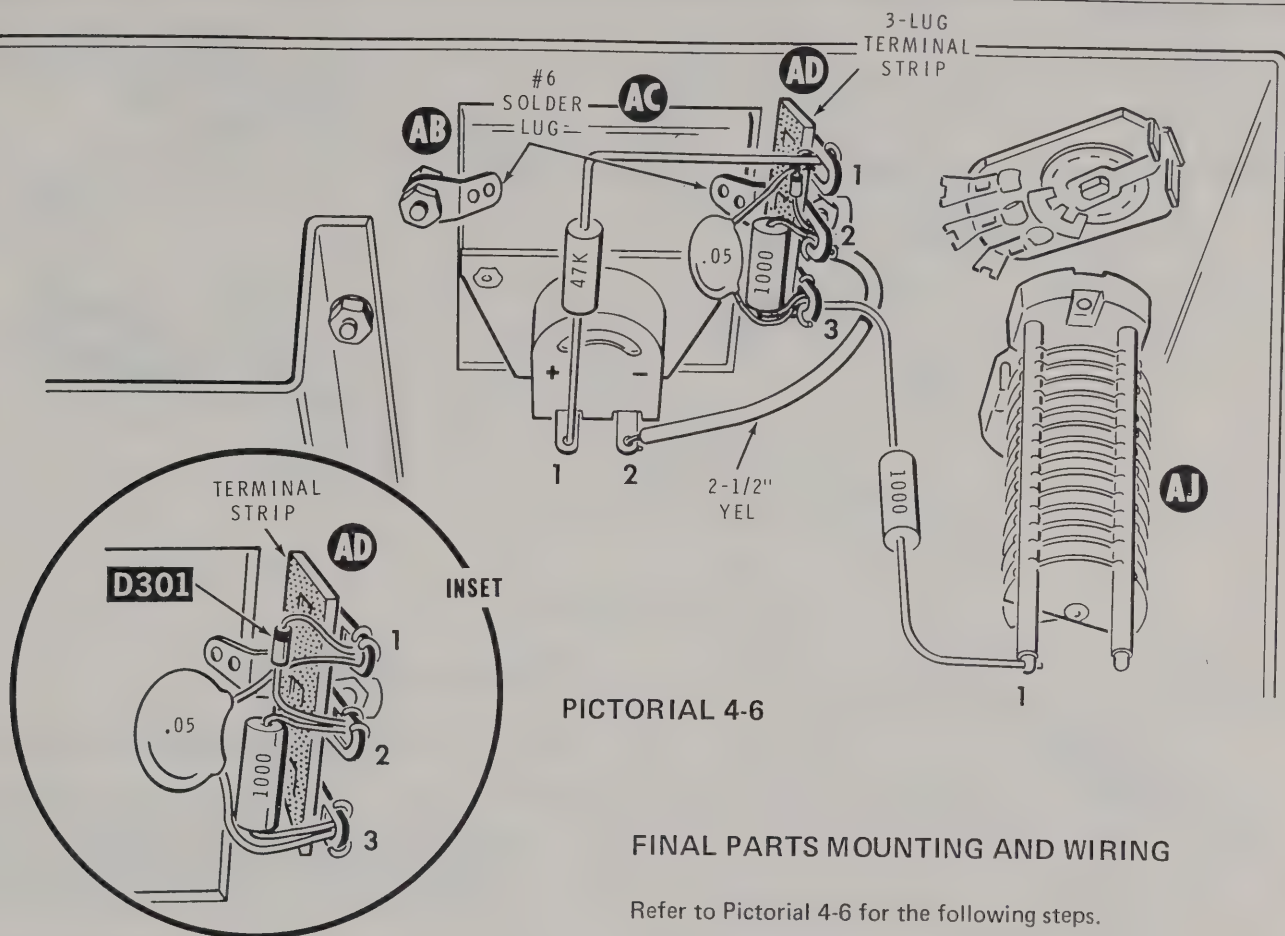
NOTE: When you perform the next step, be very careful you do not bend the plates of the capacitor.

- (✓) Carefully turn the rotor (movable plates) of the capacitor at AH fully clockwise (unmeshed).
- (✓) Turn the large knob CLOCKWISE until the mark to the left of the zero on the dial scale is lined up with the black line of the window.
- (✓) Refer to Detail 4-5B and securely tighten the two setscrews in the vernier drive.

NOTE: Do not forcefully rotate the tuning capacitor to its extreme end stops. This could damage the tuning capacitor plates.

- (✓) Rotate the large knob and turn capacitor AH to its full open or closed position; then continue to turn the large knob. The left or right end of the dial scale should stay lined up with the reference line of the window. NOTE: If the dial does not stay lined up, the capacitor shaft is slipping in the vernier drive. If this occurs, perform the previous two steps over again and make sure the set screws in the vernier drive are tight.

NOTE: Do not forcefully rotate the tuning capacitor to its extreme end stops. This could damage the tuning capacitor plates.



### FINAL PARTS MOUNTING AND WIRING

Refer to Pictorial 4-6 for the following steps.

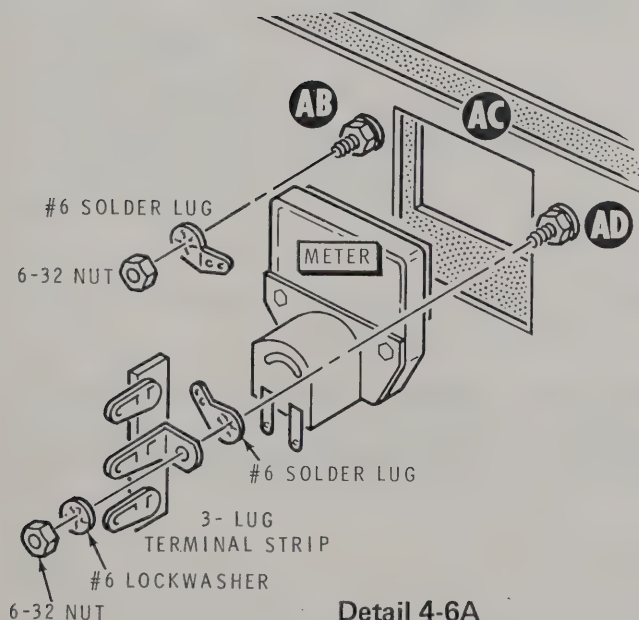
(✓) Refer to Detail 4-6A and install the signal meter at AC. Use a #6 solder lug and 6-32 nut at AB. Use a #6 solder lug, 3-lug terminal strip, #6 lockwasher, and 6-32 nut at AD. NOTE: Be sure you position the terminal strip and solder lugs as shown in the Pictorial.

(✓) R302: Connect a 1000  $\Omega$  (brown-black-red) resistor from capacitor AJ lug 1 (S-1) to terminal strip AD lug 3 (NS).

(✓) Remove the shorting wire or clip between lugs 1 and 2 of meter AC.

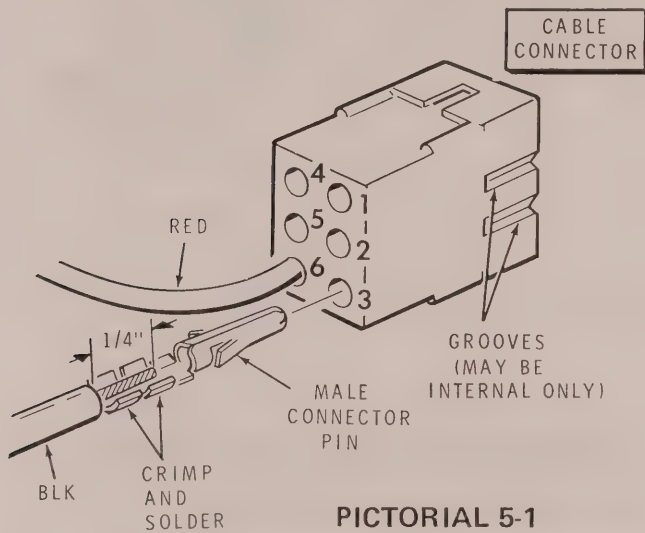
(✓) R305: Connect a 47 k $\Omega$  (yellow-violet-orange) resistor between meter AC lug 1 (S-1) and terminal strip AD lug 1 (NS).

(✓) Connect a 2-1/2" yellow wire from meter AC lug 2 (S-1) to terminal strip AD lug 2 (NS).



NOTE: Refer to the inset drawing on Pictorial 4-6 for the following steps.

- (✓) R303: Connect a 1000  $\Omega$  (brown-black-red) resistor between terminal strip AD lugs 3 (NS) and 2 (NS).
- (✓) D301: Connect the lead at the banded end of a 1N458 diode (#56-24) to terminal strip AD lug 1 (NS). Connect the other diode lead to lug 2 (S-3).
- (✓) C304: Connect a .05  $\mu$ F disc capacitor between terminal strip AD lugs 3 (S-3) and 1 (S-3).

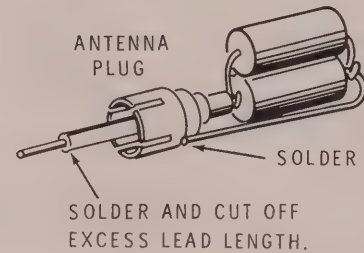
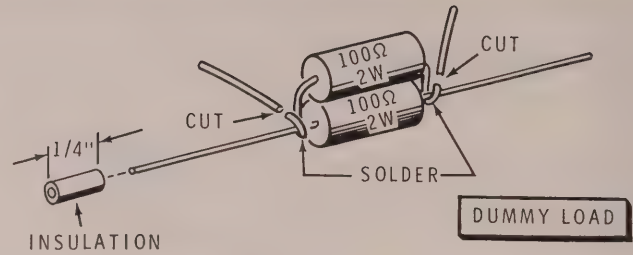


PICTORIAL 5-1

## PREPARING POWER CABLE

Refer to Pictorial 5-1 for the following steps.

- (✓) Remove 1/4" of insulation from each end of the red and the black wires supplied with the kit. Then twist the strands and apply a small amount of solder to the wire ends to hold the strands together. NOTE: Save one of the 1/4" lengths of insulation for use later.
- (✓) Install a male connector pin on one end of the red and one end of the black wires.
- (✓) Insert the connector pin on the black wire into hole 3 of the cable connector. Press the pin in until it locks in place in the cable connector.
- (✓) In the same manner, insert the connector pin on the red wire into hole 6 of the cable connector.



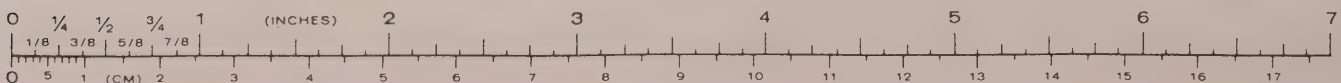
PICTORIAL 5-2

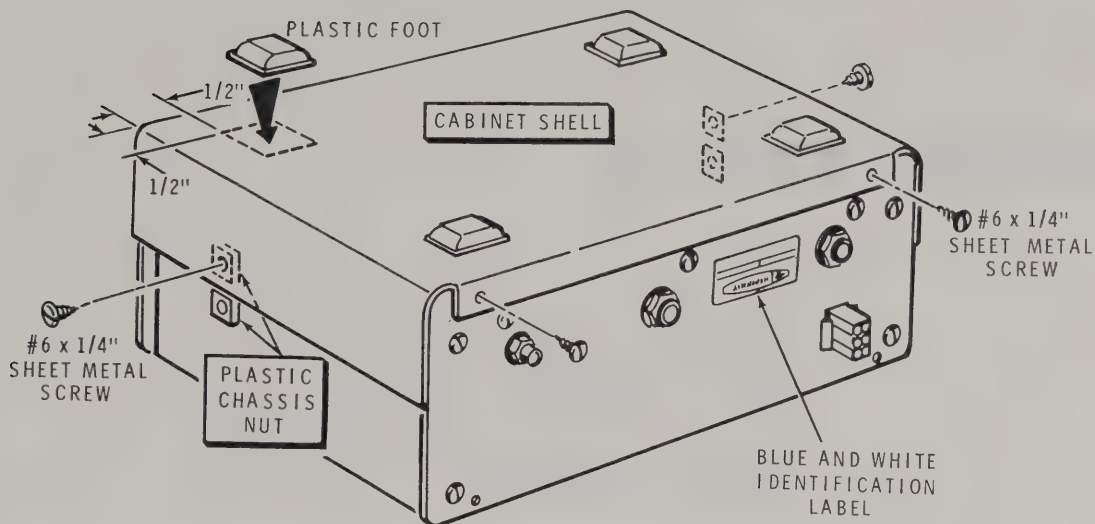
## PREPARING DUMMY LOAD

Refer to Pictorial 5-2 for the following steps.

- (✓) Locate the two 100  $\Omega$ , 2-watt (brown-black-brown) resistors. Bend the leads of one resistor around the leads of the other resistor as shown. Then solder both connections and cut off the indicated resistor leads.
- (✓) Place the previously saved 1/4" length of insulation on one lead of the resistor assembly.
- (✓) Insert this lead of the assembly into the antenna plug as shown. Then solder the lead to the pin. NOTE: Apply heat to the tip of the pin only long enough to allow the solder to flow into the pin. Allow the connection to cool; then cut off the excess lead length.
- (✓) Bend the other lead as shown. Then solder the lead to the shell of the antenna plug.

This completes the wiring of your Transceiver. Carefully inspect all connections for loose wires or unsoldered connections. Remove any wire clippings or solder splashes.





PICTORIAL 5-3

Refer to Pictorial 5-3 for the following steps.

- ( ) Place a cabinet shell on the bottom of the Transceiver. Secure the shell with four #6 x 1/4" sheet metal screws at the rear and sides of the Transceiver.
- ( ) Remove the protective backing from a plastic foot. Then press the foot onto the corner of the bottom cabinet shell as shown.
- ( ) In a similar manner, install a plastic foot at each remaining corner.

NOTE: The blue and white identification label you will install in the next step shows the model number and production series number of your kit. Refer to these numbers in any communications you may have with the Heath Company regarding your kit. This will assure you of receiving the most up-to-date information in return.

- ( ) Carefully remove the backing paper from the blue and white label. Then press the label on the rear panel at the indicated location. Place the backing paper over the label and then firmly press the label on the panel.

Proceed to the "Initial Tests."

# INITIAL TESTS

The following tests are performed on your Transceiver to make sure it is operating properly before you begin alignment. If you do not obtain the indicated results at any time, turn the Transceiver off and refer to the "In Case of Difficulty" section on Page 69.

You will need a pair of high impedance (about 2000  $\Omega$ ) headphones, a key, and a 13.4-volt DC power supply to complete the Initial Tests and Alignment.

Refer to Figure 1-2 in the Illustration Booklet for the following steps.

- ( ) Set all of the front panel controls fully counterclockwise.
- ( ) Set the SIDETONE LEVEL control to the center of its rotation.
- ( ) Push the 7.0 MHz band switch in.
- ( ) Connect the 50  $\Omega$  dummy load to the ANTENNA socket on the rear panel.
- ( ) Connect a pair of headphones to the HEADPHONE jack on the rear panel.
- ( ) Connect the key to the KEY jack on the rear panel.
- ( ) Plug the power cable onto the POWER socket on the rear panel.
- ( ) Connect the power cable red lead to the + (positive) terminal and the black lead to the - (negative) terminal of a 13.4 VDC power source. CAUTION: Be sure you observe the correct polarity; otherwise the transistors in the Transceiver will be damaged.
- ( ) Turn the Transceiver power on by rotating the AF GAIN control clockwise until it "clicks" on.
- ( ) Turn the AF GAIN control to the center of its rotation. Noise should be heard in the headphones.
- ( ) Key the Transceiver. The relay should click and a sidetone should be heard in the headphones. Adjust the SIDETONE VOLUME control on the circuit board for a comfortable listening level. Release the key.
- ( ) Turn the AF GAIN control counterclockwise until it "clicks" off.

This completes the Initial Tests. Proceed to the "Alignment" section. Do not disconnect the power supply, key, or headphones from the Transceiver.

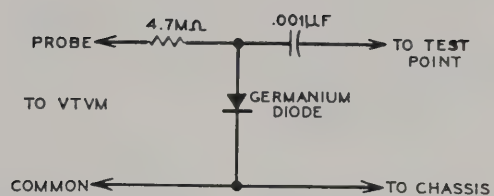


Figure 1-3

# ALIGNMENT

The following alignment procedure requires the use of a calibrated Receiver capable of receiving 7.0 to 7.25 MHz, an RF Signal Generator, and a VTVM with an RF Probe. If a Signal Generator is not available, use an on-the-air signal. Figure 1-3 is a schematic of a simple RF Probe which you can make if one is not available. CAUTION: A cabinet shell must be installed on the bottom of the Transceiver before you start the following procedure.

Refer to Figure 1-2 in the Illustration Booklet for the following procedures.

## HFO (Heterodyne Frequency Oscillator)

- (◀) Connect the RF probe of the VTVM to test point TP1. This is the lead at the indicated end of resistor R94, a 68 k $\Omega$  (blue-gray-orange) resistor.
- (↙) Turn the Transceiver on and press the 3.5 MHz pushbutton.

NOTE: You can reach the bottom slug in coils L17/L18 and L19/L21 by inserting the longer end of the alignment tool through the top slug; then on down to the bottom slug. Be careful when you do this so that you do not damage or turn the top slug.

- (✓) Use the smaller alignment tool and adjust the bottom slug in coil L17/L18 to obtain a peak reading on the VTVM. Then turn the slug an additional 1/4 turn clockwise. The VTVM should read approximately 0.6 volts. *.21V-DC    .58-AC*

- (✓) Press the 7.0 MHz pushbutton.

- (✓) Adjust the top slug in coil L17/L18 to obtain a peak reading on the VTVM. Then turn the slug an additional 1/4 turn counterclockwise. The meter should read approximately 0.6 volts. *.175V-DC    .51-AC*

- (✓) Press the 14.0 MHz pushbutton.

- (✓) Adjust the bottom slug in coil L19/L21 to obtain a peak reading on the VTVM. Then turn the slug an additional 1/4 turn clockwise. The VTVM should read approximately 0.6 volts. *.44-AC*

- (✓) Press the 21.0 MHz pushbutton.

- (✓) Adjust the top slug in coil L19/L21 to obtain a peak reading on the VTVM. The VTVM should read approximately 0.6 volts. Then turn the slug 1/4 turn counterclockwise. *.35V-AC    .315*

- ( ) Disconnect the VTVM from the Transceiver.

7/00-50  
1.04-47

## VFO (Variable Frequency Oscillator)

- (✓) Turn the calibrated receiver on and allow it to warm up. Tune the receiver to approximately 7.0 MHz.
- (✓) Press the 7.0 MHz pushbutton on the Transceiver.
- (✓) Connect one end of a suitable length of wire to the antenna terminal on the calibrated receiver. Loop the other end of this wire around coil L19/L21 as shown in inset drawing #2 on Figure 1-2.
- ( ) Turn the Transceiver on and allow it to warm up for at least 30 minutes before you proceed with the following adjustments.

NOTE: In the following steps, you will zero beat the calibrated receiver; first against its own crystal calibrator, and then against the Transceiver. A zero beat is a point where the two frequencies being combined (or beat against each other) are exactly the same. As you approach zero beat, the tone caused by the two combined frequencies will gradually decrease in pitch and volume until it stops. This point is very sharp so you must tune very carefully.

- (✓) Set the calibrated receiver's Function switch to the SSB or CW position.
- (✓) Tune the calibrated receiver to 7.0 MHz. Then turn on its crystal calibrator and zero beat the receiver frequency against the crystal calibrator frequency.
- (✓) Turn off the crystal calibrator. NOTE: Be careful that you do not change the setting of the receiver frequency.
- (✓) Refer to inset drawing #1 of Figure 1-2 and insert the metal blade (#205-778) into the small end of the plastic nut starter.

NOTE: Use the alignment tool that you made from the nut starter and blade for all trimmer adjustments. DO NOT use a screwdriver.

- (✓) Turn the Transceiver tuning dial to 0.
- ( ) Adjust trimmer capacitor C302B until you hear a zero beat from the calibrated receiver.

- ( ) Turn the Transceiver dial to 250.

- ( ) Turn the calibrated receiver dial to 7.250 MHz.

- (✓) Use the larger alignment tool to turn the slug in coil L9 until you hear a zero beat from the calibrated receiver. It may be necessary to turn down the calibrated receiver's AF gain control.

- ( ) Repeat the VFO alignment steps several times until the calibrated receiver's dial coincides with the 0 and 250 marks on the Transceiver's dial.

- ( ) Turn off the calibrated receiver and remove the wire from around coil L19/L21 in the Transceiver. The calibrated receiver will no longer be used.

## MIXER AMPLIFIER

- (✓) Turn the Transceiver tuning dial to 100.
- (✓) Connect the RF Probe of the VTVM to test point TP2. This is the lead at the indicated end of R49, a 270  $\Omega$  (red-violet-brown) resistor.
- (✓) Press the 3.5 MHz pushbutton and adjust coil L13 for a peak reading on the VTVM. 1.25-06
- (✓) Press the 7.0 MHz pushbutton and adjust coil L14 for a peak reading on the VTVM. 1.13
- (✓) Press the 14.0 MHz pushbutton and adjust coil L15 for a peak reading on the VTVM. .71
- (✓) Turn the Transceiver tuning dial to 150.

NOTE: When you perform the next step, you may have to turn the coil slug several turns counterclockwise before you obtain a peak reading on the VTVM.

- (✓) Press the 21.0 MHz pushbutton and adjust coil L16 for a peak reading on the VTVM. 1.2
- (✓) Disconnect the RF Probe from Test point TP2.

## TRANSMITTER

(✓) Plug the previously prepared 50  $\Omega$  dummy load into the ANTENNA socket on the back of the Transceiver. (This may already be connected to the Transceiver.)

(✓) Connect the key to the KEY jack on the back of the Transceiver. (This also may already be connected to the Transceiver.)

NOTE: Use the alignment tool that you made from the nut starter and blade for all trimmer adjustments. DO NOT use a screwdriver.

3/3/91  
(✓) Turn the screws in trimmers C95, C99, C103, and C106 clockwise until they stop turning. Do not force the screws.

(✓) Turn the screw in trimmer C95 1/2 turn counterclockwise.

(✓) Turn the screw in trimmer C99 1/8 turn counterclockwise.

(✓) Turn the screw in trimmer C103 1 turn counterclockwise.

(✓) Turn the screw in trimmer C106 1/4 turn counterclockwise.

(✓) Make sure the TUNING dial is set to 100.

(✓) Press the 3.5 MHz pushbutton.

(✓) Set the LOADING control on the front panel to the 12 o'clock position.

(✓) Press the 7.0 MHz pushbutton.

(✓) Set the LOADING control to the 12 o'clock position.

(✓) Key the Transceiver and adjust trimmer C99 to obtain a maximum reading on the RELATIVE POWER meter.

(✓)? Key the Transceiver and adjust the LOADING control on the front panel to obtain a maximum reading on the RELATIVE POWER meter.

(✓)? Repeat the previous two steps.

(✓) Press the 14.0 MHz pushbutton.

(✓) Set the LOADING control to the 12 o'clock position.

(✓)? Key the Transceiver and adjust trimmer C103 to obtain a maximum reading on the RELATIVE POWER meter.

(✓)? Key the Transceiver and adjust the LOADING control on the front panel to obtain a maximum reading on the RELATIVE POWER meter.

(✓)? Repeat the previous two steps.

(✓) Press the 21.0 MHz pushbutton.

(✓) Set the LOADING control to the 12:00 o'clock position.

(✓) Key the Transceiver and adjust trimmer C106 to obtain a maximum reading on the RELATIVE POWER meter.

(✓) Key the Transceiver and adjust the LOADING control to obtain a maximum reading on the RELATIVE POWER meter.

(✓) Repeat the previous two steps.

(✓) Turn the Transceiver off.

(✓) Disconnect the key and dummy load from the Transceiver.

NOTE: In the following steps, the adjustments will be quite broad.

NEEDLE POINT  
(✓)? Key the Transceiver and adjust trimmer C95 for a maximum reading on the RELATIVE POWER meter.

(✓)? Key the Transceiver and adjust the LOADING control on the front panel to obtain a maximum reading on the RELATIVE POWER meter.

(✓)? Repeat the previous two steps.

## RECEIVER

- (✓) Connect a pair of headphones to the HEADPHONES jack on the back of the Transceiver.

NOTE: You may use a nearby accurately calibrated transmitter for the following adjustments. If you do use one, connect a small piece of wire to the Transceiver's antenna socket. The small wire will act as a simple antenna. (You may also use an appropriate antenna.)

- (✓) Connect a signal generator to the ANTENNA socket on the back of the Transceiver.
- (✓) Turn the signal generator on and allow it to warm up.
- (✓) Set the Transceiver tuning dial to 250.
- (✓) Set the RECEIVER PRESELECTOR to 14.
- (✓) Set the RF GAIN control to MAX.
- (✓) Turn the Transceiver on and adjust the AF GAIN control for a comfortable listening level.

NOTE: In the following steps, as you approach the point of resonance of a trimmer capacitor or coil, the sound from the headphones will increase. As this occurs, decrease the output of the signal generator to the lowest level that you can still hear. This will prevent overloading the receiver.

- (✓) Press the 3.5 MHz pushbutton.
- (✓) Adjust the signal generator frequency to approximately 3.750 MHz or until you hear the signal in the headphones. The output of the generator may have to be quite high.
- (✓) Alternately adjust trimmers C3 and C16 for maximum sound in the headphones.
- (✓) Press the 7.0 MHz pushbutton.

CHECK D2 & D6 FOR SHORT

- (✓) Adjust the signal generator frequency to approximately 7.25 MHz or until you hear it in the headphones. The output of the generator may have to be quite high.
- (✓) Alternately adjust trimmers C6 and C19 for maximum sound in the headphones.
- (✓) Set the Transceiver tuning dial to 100.
- (✓) Adjust the signal generator frequency to approximately 7.100 MHz or until you hear it in the headphones.
- (✓) Adjust the RECEIVER PRESELECTOR for maximum sound in the headphones.
- (✓) Readjust trimmer C6 for maximum sound in the headphones. NOTE: Do not adjust trimmer C19.
- (✓) Press the 14.0 MHz pushbutton.
- (✓) Set the Transceiver tuning dial to 250.
- (✓) Set the RECEIVER PRESELECTOR to 14.
- (✓) Adjust the signal generator frequency to approximately 14.25 MHz or until you hear it in the headphones.
- (✓) Alternately adjust trimmers C7 and C22 for maximum sound in the headphones.
- (✓) Press the 21.0 MHz pushbutton.
- (✓) Adjust the signal generator frequency to approximately 21.25 MHz or until you hear it in the headphones.
- (✓) Alternately adjust trimmers C9 and C24 for maximum sound in the headphones.
- ( )<sup>ND</sup> Turn the Transceiver off.
- (✓) Disconnect the signal generator from the Transceiver.

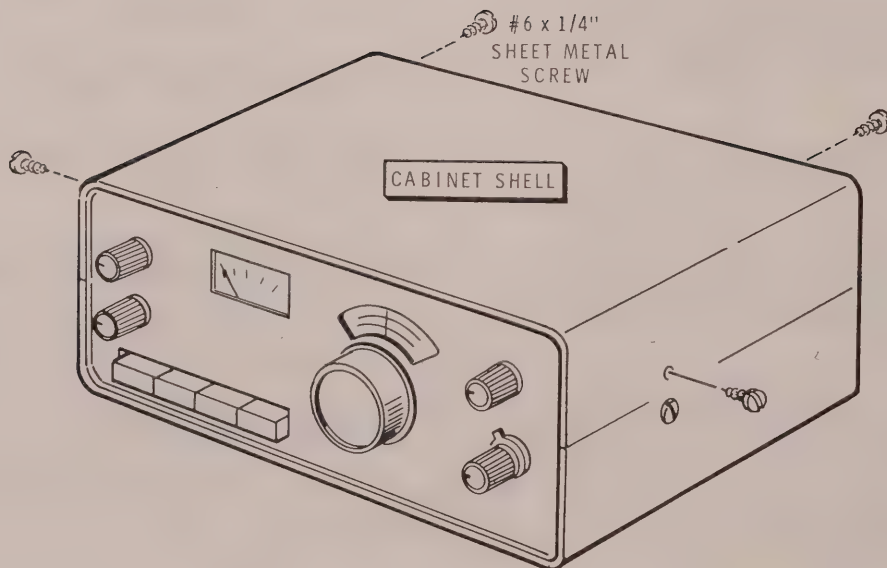
This completes the "Transceiver Alignment." Proceed to "Final Assembly."

# FINAL ASSEMBLY

Refer to Pictorial 5-4 for the following steps.

- ( ) Place the remaining cabinet shell on the Transceiver as shown.
- ( ) Secure the cabinet shell to the Transceiver with #6 x 1/4" sheet metal screws at the rear and sides as shown.

This completes the assembly of your Transceiver. Proceed to "Operation."



PICTORIAL 5-4



# OPERATION

Refer to Figure 1-2 for the following steps.

- ( ) Plug the power cable onto the POWER socket on the rear panel.
- ( ) Connect the power cable red lead to the + (positive) terminal and the black lead to the — (negative) terminal of a 13.4 VDC power source. CAUTION: Be sure you observe the correct polarity; otherwise the transistors in the Transceiver will be damaged.
- ( ) Connect a key to the KEY jack on the rear panel.
- ( ) Connect an antenna to the ANTENNA socket on the rear panel. (See the following information on antennas.)
- ( ) Connect a pair of headphones to the HEADPHONES jack on the rear panel.

## ANTENNAS

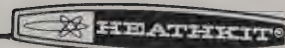
The Transceiver should be used with 50 ohm to 75 ohm antennas having a low VSWR. Lightweight hookup wire dipoles and inverted vee's are sufficient for solid contacts. They can be quickly strung up for camping trips and emergency operation, as well as field day use. However, antennas of the beam and quad type will provide a significant improvement in performance, much more so than for medium to high-power rigs.

The "ARRL Antenna Book" is commonly available and includes comprehensive reference work on transmission lines and antennas. Other similar handbooks for the amateur are offered for sale and can often be found in a public library.

- ( ) Push in the Band switch for the band you intend to operate on.
- ( ) Turn the Transceiver on by rotating the AF GAIN control clockwise until it "clicks" on. Then continue to rotate the control clockwise to a comfortable listening level.
- ( ) Adjust the Main Tuning to the portion of the band where you intend to operate.

NOTE: When tuning across the band, always go to the high end of the band first and tune down to the low end. This is to assure that you will be on the high side of the zero beat when listening to a signal. Otherwise you may answer a CQ on the low side of zero beat and your transmitting frequency will be too low.

- ( ) Listen to the headphones and adjust the RECEIVER PRESELECTOR for maximum signal loudness (fully clockwise for 15 and 20 meter operation).
- ( ) Key the Transceiver and rotate the LOADING control to obtain a maximum meter indication. The Transceiver is now ready for on-the-air operation.



## OPERATING HINTS

When operating a QRP (low power) rig, your transmitted signal may be below the signal level preferred by most operators. Generally, lower power signals lose out unless a few simple techniques are followed. In many cases, listening for a CQ is more acceptable since your signal has a greater chance of being copied this way. Or you can try to contact a station just after he completes a contact. Also, be sure that you are on the high side of zero beat when you transmit as described previously.

Emergency operation is sometimes a necessity and always unexpected. The Transceiver is well suited for these situations if an antenna is available. A power source is usually no problem since any automobile battery or lantern

batteries of the appropriate voltage can provide hours of dependable operation. Refer to the "Specifications" section for voltage and current requirements.

You can vary the hold-in time of the antenna relay by adjusting BREAK-IN DELAY control R68 on the main circuit board. Adjust this control to obtain the desired delay after you have released the key.

Look for QRP operators on the following frequencies:

3.354 MHz	21.040 MHz
7.040 MHz	28.040 MHz
14.065 MHz	

# IN CASE OF DIFFICULTY

This part of the Manual will help you locate and correct any difficulties which might occur. This information is divided into:

Visual Checks.

Precautions for Bench Testing.

Troubleshooting Chart.

NOTE: If you prefer to have your Transceiver repaired at the factory or at one of the Heathkit Electronic Centers, or if you need additional information before you proceed, refer to the "Customer Service" information inside the rear cover of this Manual. Your Warranty is located inside the front cover.

MARCH 20 2 1/2 hrs  
21 2 hrs  
22 2 hrs  
MARCH 24 6 hrs  
25 2 hrs  
26 6 hrs

## VISUAL CHECKS

1. About 90% of the kits that are returned for repair do not function properly due to poor soldering. Therefore, you can eliminate many troubles by a careful inspection of connections to make sure they are soldered as described on Page 6 of this Manual and in the Soldering section of the "Kit Builders Guide." Reheat any doubtful connections and be sure all the wires are soldered at places where several wires are connected. Check carefully for solder bridges between circuit board foils.
2. Check to be sure that all transistors and diodes are in their proper locations, and are installed correctly.
3. Check the value of each part. Be sure that the proper part has been wired into the circuit, as shown in the Pictorial diagrams and as specified in the wiring instructions. It would be easy, for example, to install a 220  $\Omega$  (red-red-brown) resistor in a step that calls for a 22 k $\Omega$  (red-red-orange) resistor.
4. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as you check it. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you have consistently overlooked.
5. Check all of the wires that are connected to the circuit board to be sure they do not touch the chassis or other lugs. Make sure all wires are properly soldered.
6. A review of the "Circuit Description" may help you to determine the problem.
7. If the difficulty still is not cured, read the "Precautions for Bench Testing" section, and the section titled "Troubleshooting Charts."

## PRECAUTIONS FOR BENCH TESTING

NOTE: Use a high input impedance voltmeter for voltage measurements.

1. Be cautious when testing transistor circuits. Although transistors have almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than other circuit components.
2. Be sure you do not short circuit any terminals when you make voltage measurements. If the probe should slip, for example, and short out a bias or voltage supply point, it is almost certain to damage one or more transistors or diodes.
3. Do not remove any components while the kit is operating; this could cause considerable damage.

If you make repairs to your Transceiver, make sure you eliminate the cause as well as the effect of the trouble. If, for example, you should find a damaged resistor, be sure to find out what caused the resistor to become damaged. If the cause is not eliminated, the replacement resistor may also become damaged when the Transceiver is put back into operation.

## Troubleshooting Chart

The following chart lists conditions and possible causes of several specific malfunctions. If a particular part is mentioned (Q7 for example) as a possible cause, check that part to see that it is installed and/or wired correctly. It is also possible, on rare occasions, for a part to be faulty and require replacement.

CONDITION	POSSIBLE CAUSE
No signals can be received on any band. However, headphone noise is heard when the AF Gain control is advanced.	1. Transistor Q1 or IC1 is incorrectly installed or shorted.
No signals are received on the 3.5 MHz band.	1. Diode D1 or D5 incorrectly installed or shorted.
No signals are received on the 7.0 MHz band.	1. Diode D2 or D6 incorrectly installed or shorted.
No signals are received on the 14.0 MHz band.	1. Diode D3 or D7 incorrectly installed or shorted.
No signals are received on the 21.0 MHz band.	1. Diode D4 or D8 incorrectly installed or shorted.
No sound of any kind from the headphones.	1. Transistor Q201 or IC2 incorrectly installed or shorted. 2. Phone jack J301 incorrectly wired.
Heterodyne frequency oscillator does not operate on any band.	1. Transistor Q6 incorrectly installed or shorted.
Heterodyne frequency oscillator does not operate on one band. (Other bands are OK.)	1. The associated diodes for the inoperative band (D22 thru D29) may be incorrectly installed or shorted. 2. The crystal for the inoperative band may be faulty.

## TROUBLESHOOTING CHART (cont'd.)

CONDITION	POSSIBLE CAUSE
Sidetone does not operate.	1. Diode D21 or IC2 is incorrectly installed or shorted.
Relay does not operate.	1. Transistor Q12 or Q13 is incorrectly installed or shorted.
Relative power meter does not operate.	1. Trimmer capacitors, C95, C99, C103, C106, and C303 are not properly adjusted.  2. Transistor Q8, Q9, or diode D301 are incorrectly installed or shorted.
Relative power meter does not operate on one band only.	1. The trimmer capacitor for that band (C95, C99, C103, or C106) is not properly adjusted.  2. The diode associated with that band is incorrectly installed or shorted. (Diodes D16, D17, D18, D19, D31, D32, D33, D34, D35, D36, D37, or D38.)  3. The heterodyne frequency oscillator is not properly tuned for that band.

# SPECIFICATIONS

## TRANSMITTER

DC Power Input	
80 meters . . . . .	3.5 watts.
40 meters . . . . .	3.0 watts.
20 meters . . . . .	3.0 watts.
15 meters . . . . .	2.5 watts.
Frequency Control . . . . .	Built-in VFO.
Output Impedance . . . . .	50 $\Omega$ unbalanced.
Sidetone . . . . .	Built-in, adjustable volume.
Spurious and Harmonic Levels . . . . .	At least 35 db down.
Transmit Frequency Offset . . . . .	Approximately 750 Hz lower, fixed on all bands.

## RECEIVER

Receiver Type . . . . .	Direct conversion with RF amplifier, balanced product detector, and active audio filter.
Sensitivity . . . . .	1 microvolt or less for 10 dB $\frac{S+N}{N}$ . 0.2 $\mu$ V provides readable signal.
Selectivity . . . . .	Wide — 750 Hz @ 6 dB down. Narrow — 375 Hz @ 6 dB down.
Passband Center Frequency . . . . .	750 Hz.
Type of Reception . . . . .	CW.
Audio Output Impedance . . . . .	1000 $\Omega$ nominal.

## GENERAL

Frequency Coverage . . . . .	80 meters, 3.5 to 3.75 MHz. 40 meters, 7.0 to 7.25 MHz. 20 meters, 14.0 to 14.25 MHz. 15 meters, 21.0 to 21.25 MHz.
Frequency Stability . . . . .	Less than 150 Hz/hour drift after 60 minute warm-up.
Frequency Generation . . . . .	Premixed VFO and HFO.
Power Requirements . . . . .	13.4 volts DC, nominal. 90 mA receive mode, and 430 mA transmit mode.
Dimensions . . . . .	9-1/4" wide x 8-1/2" deep x 4-1/4" high, including knobs and feet. (23.5 cm wide x 21.6 cm deep x 10.8 cm high.)
Weight . . . . .	4 lbs. (1.8 kg.)

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The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.



# CIRCUIT DESCRIPTION

Refer to the Schematic Diagram and the Block Diagram in the Illustration Booklet while you read the following description.

The Transceiver operates in the CW portion of the 15, 20, 40, and 80 meter amateur bands. The frequencies are generated by the combined efforts of the VFO and the heterodyne oscillator for both transmit and receive operation. In the following paragraphs, each part of the Transceiver circuitry will be discussed in detail.

## VFO

FET (field effect transistor) Q2 and its associated circuitry forms a Hartley oscillator. Part of coil L9, tuning capacitor C302, and temperature compensating capacitors C44, C45, C46, C47, C48, C49, and C51 determine the frequency of the oscillator. The other part of L9 is a feedback circuit that couples part of the generated signal back to the gate of FET Q2 to help sustain oscillation. The VFO generates frequencies from 8.645 MHz to 8.895 MHz.

Diode D9 clamps the positive-going half of the signal to prevent FET Q2 from reaching high peak operating currents. This helps to keep the VFO from generating harmonic frequencies.

The signal from the VFO is coupled through capacitor C54 and C56 to emitter follower transistor Q3. This transistor provides isolation for the VFO. The output from the emitter of transistor Q3 is coupled to the balanced mixer.

When the Transmitter is keyed, diode D11 effectively adds capacitor C55 to the circuit which causes a shift in the VFO frequency. This produces a fixed offset during transmit. Zener diode ZD1 provides voltage regulation for the drain of FET Q2.

## HFO

The HFO operates at any of four crystal-controlled frequencies, depending on which band switch is depressed. These frequencies, when mixed with the VFO frequency, establish the four bands of operation.

When the 3.5 MHz pushbutton switch on the front panel is depressed, crystal Y1 and its associated circuitry are electrically connected to transistor Q6 to form the HFO. At this time power is supplied to the circuit through resistor R78 and crystal Y1 oscillates at a frequency of 12.395 MHz, which is coupled through diode D22 to transistor Q6. A part of the signal from the collector of transistor Q6 is coupled back through diode D23 and through the tuned circuit composed of coil L17 and capacitor C116 to sustain oscillation. Diodes D22 and D23 prevent DC from activating this crystal circuit when a different crystal circuit is being used. The HFO operates similarly on the other bands.

The HFO signal is coupled through capacitor C127 to emitter follower transistor Q7. This transistor provides isolation for the oscillator circuit to prevent loading. From the emitter of transistor Q7, the signal is coupled to the balanced mixer.

## BALANCED MIXER

Coils L11 and L12 and diodes D12, D13, D14, and D15 form a balanced mixer which combines the VFO and HFO signals. This produces four signals at the output of the balanced mixer. These are the VFO frequency plus the HFO frequency, the HFO frequency minus the VFO frequency, the VFO frequency, and the HFO frequency. The only frequency that we are concerned with is the HFO frequency minus the VFO frequency.

## MIXER AMPLIFIER

The four signals are then coupled through capacitor C61 to FET Q4 where they are amplified and then coupled to the four diode-selected filter circuits. Only one filter circuit is electrically connected to the circuit on any one band. For example, if the 3.5 MHz pushbutton switch on the front panel is depressed, coil L13 and capacitor C64 are electrically connected to the circuit. This tuned circuit filters out the three unwanted signals and leaves only the "on-frequency" signal, which is coupled through capacitor C73 to transistor Q5.

Transistor Q5 is connected as an emitter follower which provides isolation and impedance matching. The output from the emitter of Q5 is coupled through C75 to transistor Q8 and also through capacitor C28 to balanced product detector IC1.

## TRANSMITTER

The output of driver transistor Q8 is resonance-tuned by the appropriate diode-switched tuned circuit. Here again, there are four tuned circuits. Only one tuned circuit is electrically connected to the output of Q8 for each band of operation. For the 3.5 MHz band, coil L22 and capacitor C77 and C78 are connected through diodes D31 and D35.

The output from the driver is coupled to final amplifier transistor Q9. Here the signal is amplified and then coupled through the appropriate switch (part of the depressed front panel switch) to the output circuit, which acts as a bandpass filter and impedance matching network.

Zener diode ZD2 prevents excessive collector RF voltage from destroying transistor Q9 if the operator should mistakenly key the transmitter when there is no load present on the output of the Transmitter, or when the SWR is high.

Capacitor C303 is the Loading control and is adjusted for maximum power on the relative power meter. The RF power output is then coupled through antenna switching relay RL1 and to antenna jack J302. A small part of the RF power output is coupled through resistor R302, and capacitor C304 to the relative power meter. This output power is rectified by diode D301.

## KEYING

Transistor Q11 provides a keying function when the key is depressed. This transistor provides the keying for the transmitter driving stage, the sidetone oscillator, the break-in delay switching, and the receiver muting. When the key is depressed, the keying transistor places a B+ voltage on the collector of driver transistor Q8 and switches it on. The transmitter is then keyed and provides an RF output signal.

Also, when the key is depressed, pin 11 of sidetone oscillator IC2D is connected to ground through resistor R72 and diode D21 and the key to cause the oscillator to turn on and generate an audible tone. This tone is coupled through capacitor C111, resistor R76, Sidetone Level Adjust control R77, and capacitor C113 to the headphone jack.

## BREAK-IN DELAY

Transistors Q12 and Q13 provide an adjustable delay circuit for antenna switching and receiver muting. The emitter of break-in delay transistor Q12 is connected to ground when the key is depressed. This effectively puts the collector of Q12 at ground potential, which causes relay driver transistor Q13 to energize relay RY1 and switch the antenna from receive to transmit. Relay RY1 will remain energized until the base voltage of relay driver transistor Q13 increases to the B+ voltage. The key also turns transistor Q11 on and off which switches the Transceiver between transmit and receive.

The B+ voltage at the relay is used to switch VFO offset diode D11 to provide offset during transmit and also to switch the mute transistor Q14 on. This effectively connects the input of the audio preamplifier stage to ground, thus muting the receiver during transmit.

When the key is released, the emitter and collector voltages of Q12 try to increase toward B+. However, at this time, capacitor C92 is discharging through delay control R68, which keeps the relay energized. After capacitor C92 has discharged and the voltage on the collector of Q13 returns to normal, the relay opens. The amount of time required for capacitor C92 to discharge is adjustable through delay control R68.

## RECEIVER CIRCUITS

The signals received by the antenna are coupled through RF Gain control R302 and through the appropriate front panel pushbutton switch (for example we will say the 3.5 MHz band switch). From here, the signal is coupled through coil L1 and diode D1 to RF amplifier Q1. Coil L1 and capacitors C1, C3, and C301A form a resonant circuit. Diode D1 provides the electrical switching to connect the signal to FET Q1 when the 3.5 MHz switch is depressed.

The signal is amplified by FET Q1 and is filtered by one of the coil-capacitor networks. (Each network serves as a filter for one of the four bands.) This filtered signal is then coupled through capacitor C25 to pin 1 of IC1, the balanced product detector. IC1 mixes the premixed VFO signal with the received signal to produce an audio signal. This signal is present at pin 9 of IC1 and is coupled through capacitors C33, C35, and resistor R19 to pin 3 of IC2A.

IC2A and IC2B are active audio filters. The audio signal passes through these two stages of audio filtering, which removes any RF signal and produces an audio signal that has good audio bandwidth and excellent skirt selectivity. There are two stages of audio selectivity which are selected by Selectivity switch SW302 on the front panel.

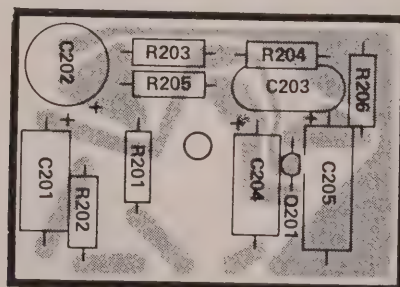
From the Selectivity switch, the signal is coupled through capacitor C38 to IC2C. IC2C is an audio preamplifier which amplifies the signal and then couples it through resistor R202 and capacitor C201 to transistor Q201. Transistor Q201 further amplifies the signal and then it is coupled through capacitor C204 to headphone jack J301.

# CIRCUIT BOARD

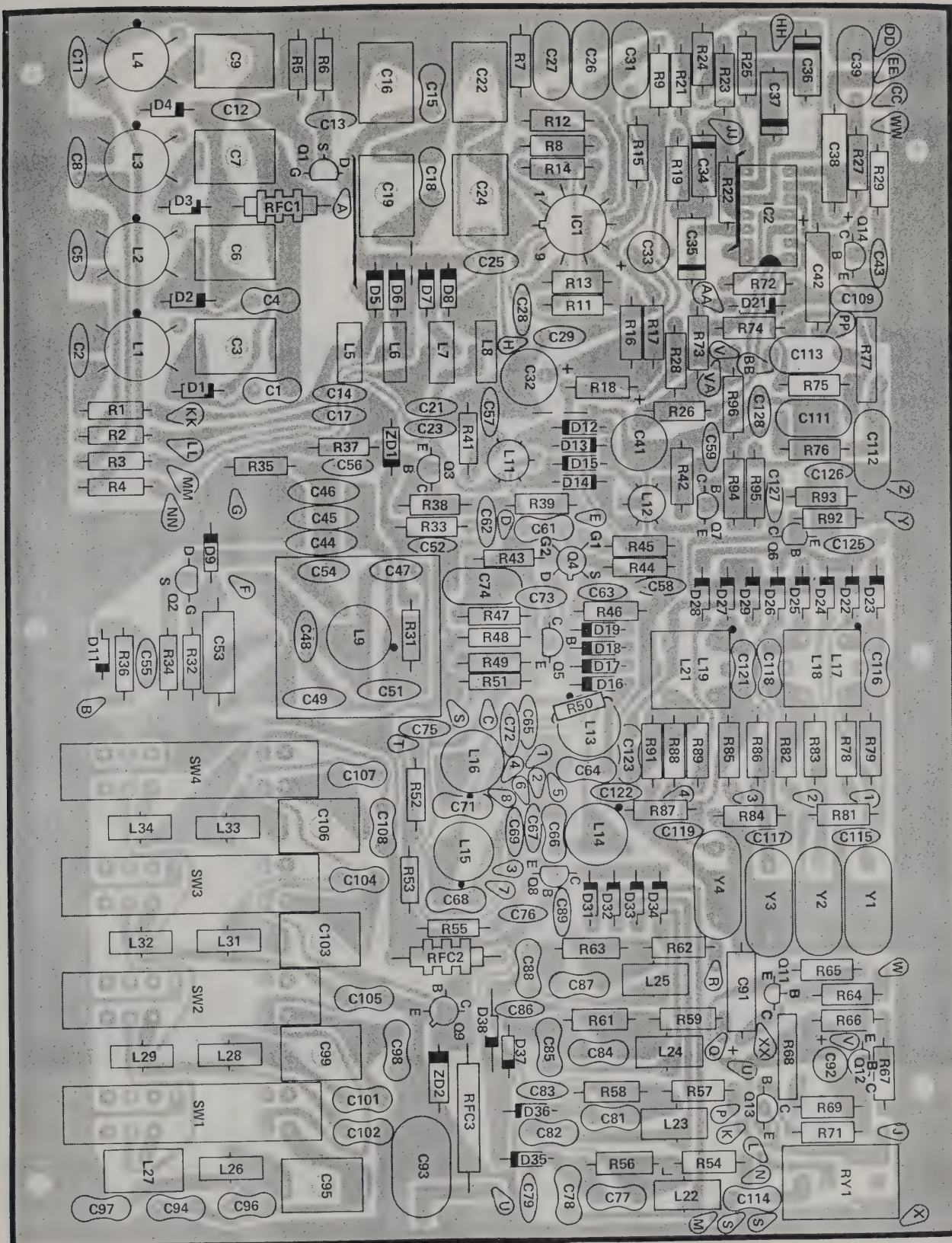
## X-RAY VIEWS

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

- A. Find the circuit component number (R5, C3, etc.) on the "Circuit Board X-Ray Views."
- B. Locate this same number in the "Circuit Component Number" column of the "Parts List" in the front of this Manual.
- C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.

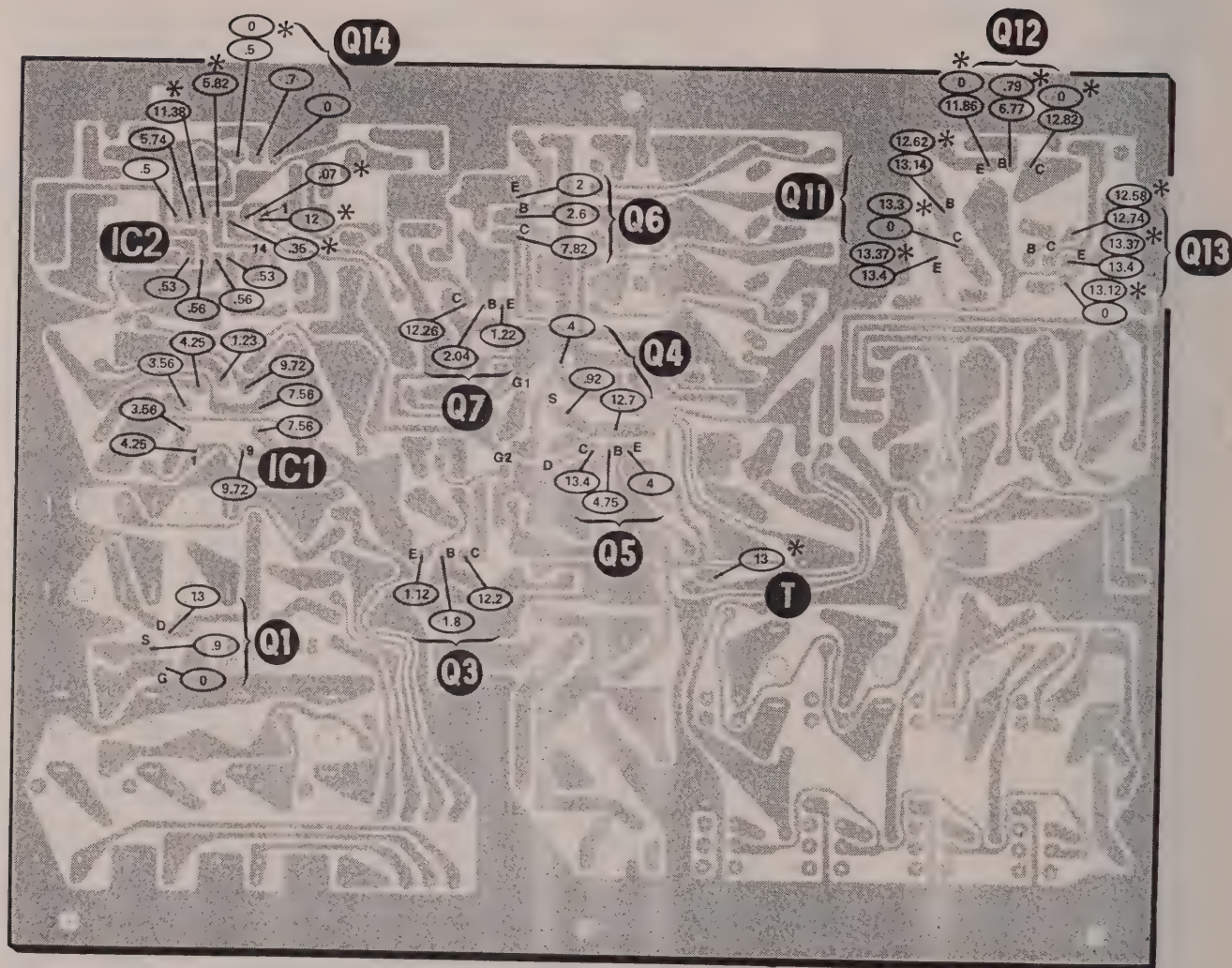


AF AMPLIFIER CIRCUIT BOARD  
(Viewed from foil side)



MAIN CIRCUIT BOARD  
(Viewed from foil side)

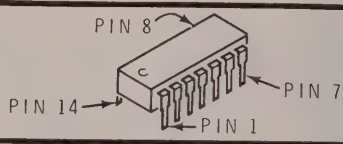
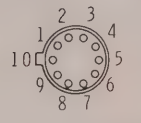
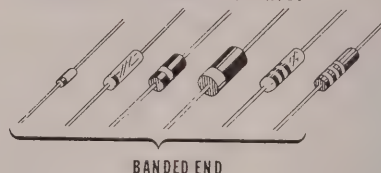
# CIRCUIT BOARD VOLTAGE CHART

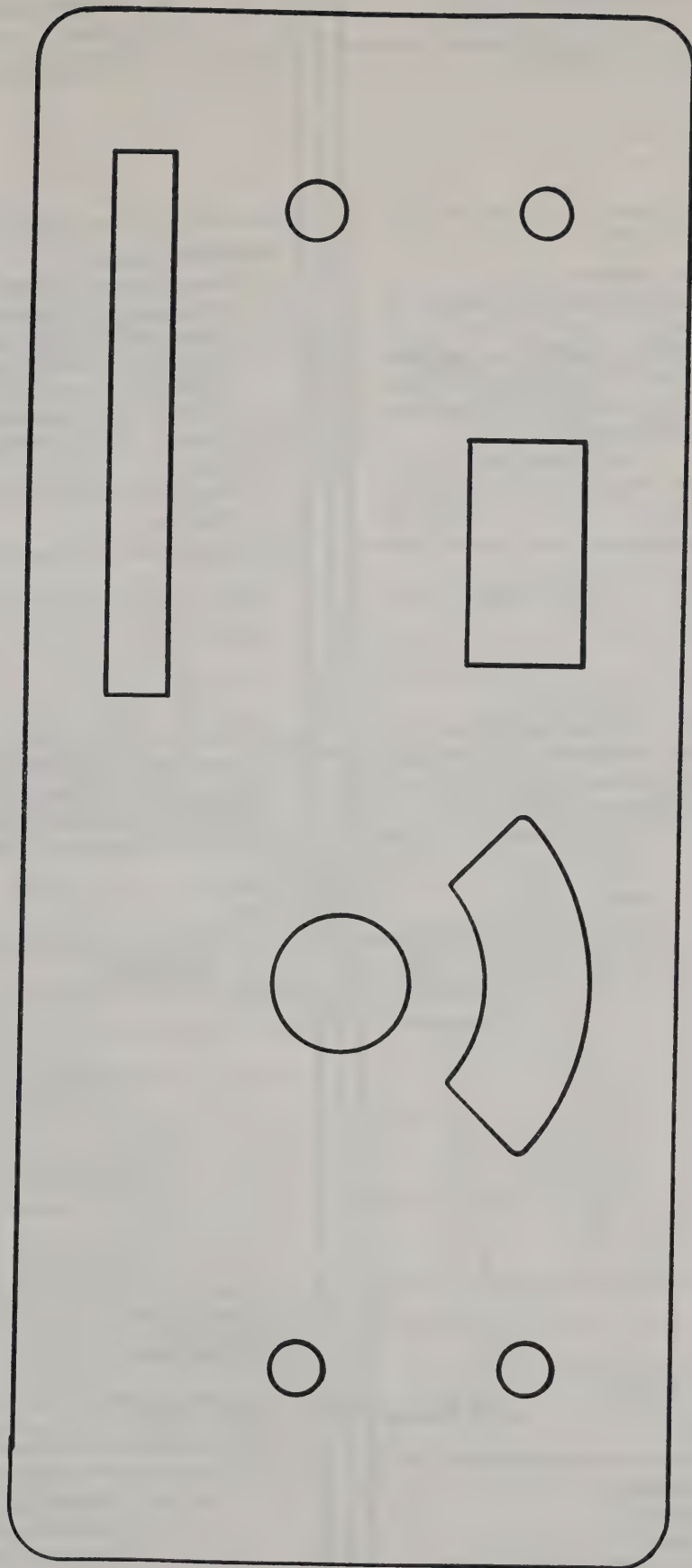


# IDENTIFICATION CHART

COMPONENT	HEATH PART NUMBER	TYPE NUMBER	IDENTIFICATION
Q13	417-201	X29A829	
Q1, Q2	417-169	MPF105	
Q11	417-116	S2091	
Q6, Q8	417-172	MPS-6521	
Q3, Q5, Q7, Q12, Q14, Q201	417-801	MPS-A20	
Q4	417-240	40673	
Q9	417-880	2N4427	

## IDENTIFICATION CHART (Cont'd)

COMPONENT	HEATH PART NUMBER	TYPE NUMBER	IDENTIFICATION
IC2	442-71	LM3900	
IC1	442-96	MC1496	 (BOTTOM VIEW)
ZD1	56-19	VR-9.1	<p>IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.</p> 
ZD2	56-55	VR-36	
D12, D13, D14, D15	56-87	FH100	
D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D16, D17, D18, D19, D21, D31, D32, D33, D34, D35, D36, D37, D38	56-24	1N458	
D22, D23, D24, D25, D26, D27, D28, D29,	56-56	1N4149	



**FOR PARTS REQUESTS ONLY**

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

**DO NOT WRITE IN THIS SPACE****INSTRUCTIONS**

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, \$3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

Total enclosed \$ \_\_\_\_\_

- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_ ZIP \_\_\_\_\_

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # \_\_\_\_\_ Invoice # \_\_\_\_\_  
Date \_\_\_\_\_ Location \_\_\_\_\_  
Purchased \_\_\_\_\_ Purchased \_\_\_\_\_

LIST <b>HEATH</b> PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE

TOTAL FOR PARTS

HANDLING AND SHIPPING

MICHIGAN RESIDENTS ADD 4% TAX

TOTAL AMOUNT OF ORDER

SEND TO: **HEATH COMPANY**  
BENTON HARBOR  
MICHIGAN 49022  
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

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- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

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Total enclosed \$ \_\_\_\_\_

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NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_ ZIP \_\_\_\_\_

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Model # \_\_\_\_\_ Invoice # \_\_\_\_\_  
Date \_\_\_\_\_ Location \_\_\_\_\_  
Purchased \_\_\_\_\_ Purchased \_\_\_\_\_

LIST <b>HEATH</b> PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE

TOTAL FOR PARTS

HANDLING AND SHIPPING

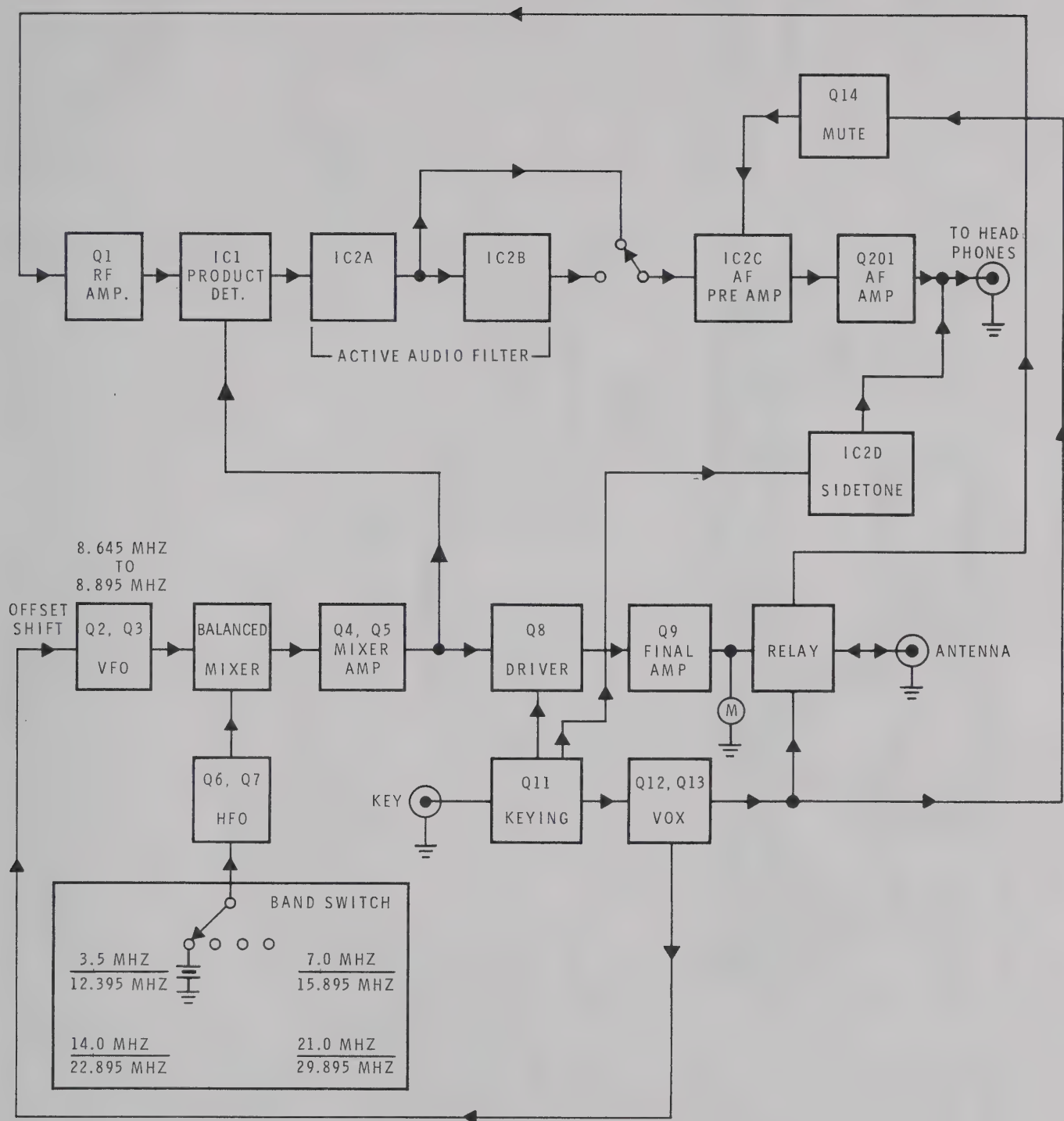
MICHIGAN RESIDENTS ADD 4% TAX

TOTAL AMOUNT OF ORDER

SEND TO: **HEATH COMPANY**  
BENTON HARBOR  
MICHIGAN 49022  
ATTN: PARTS REPLACEMENT

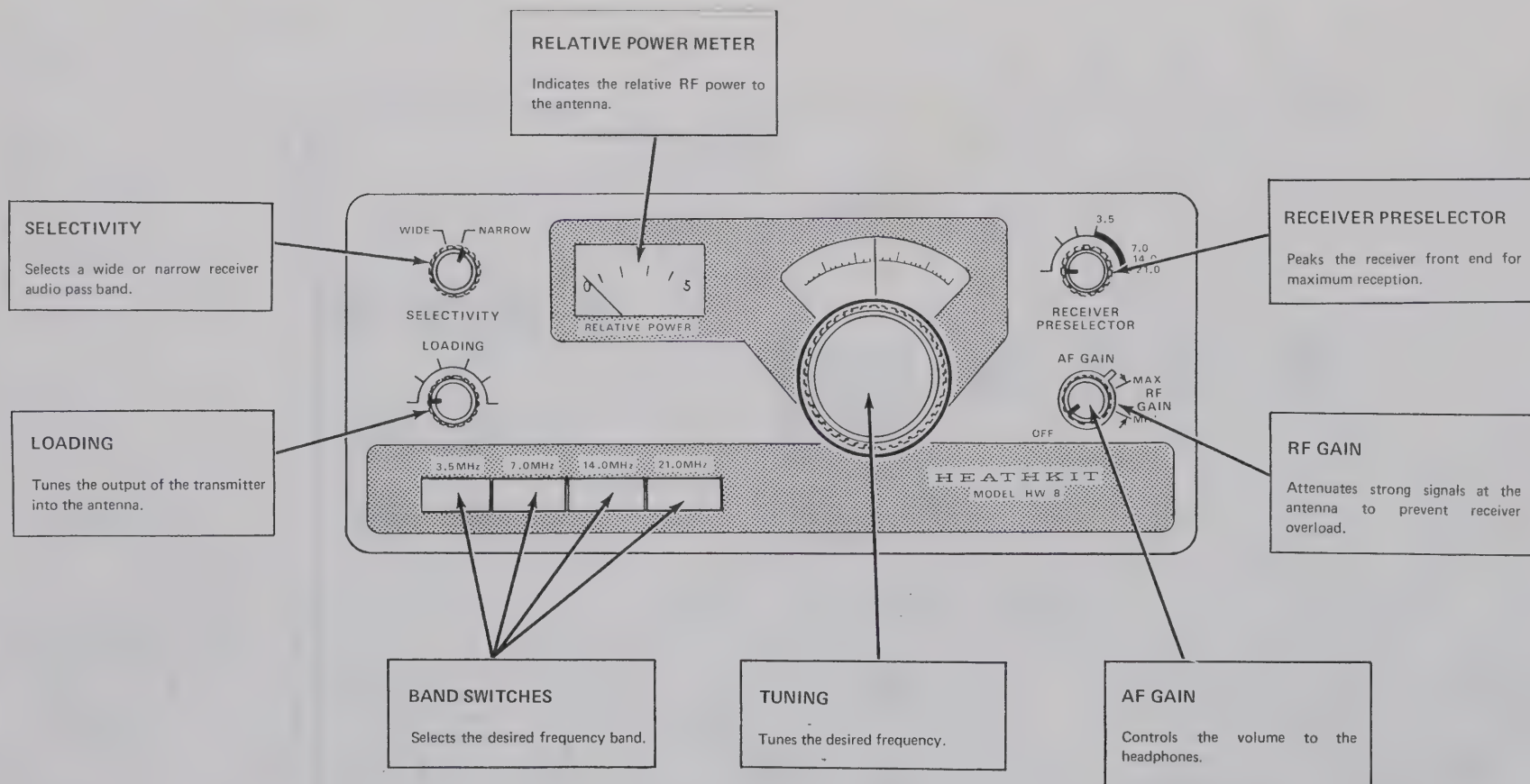
Phone (Replacement parts only): 616 982-3571

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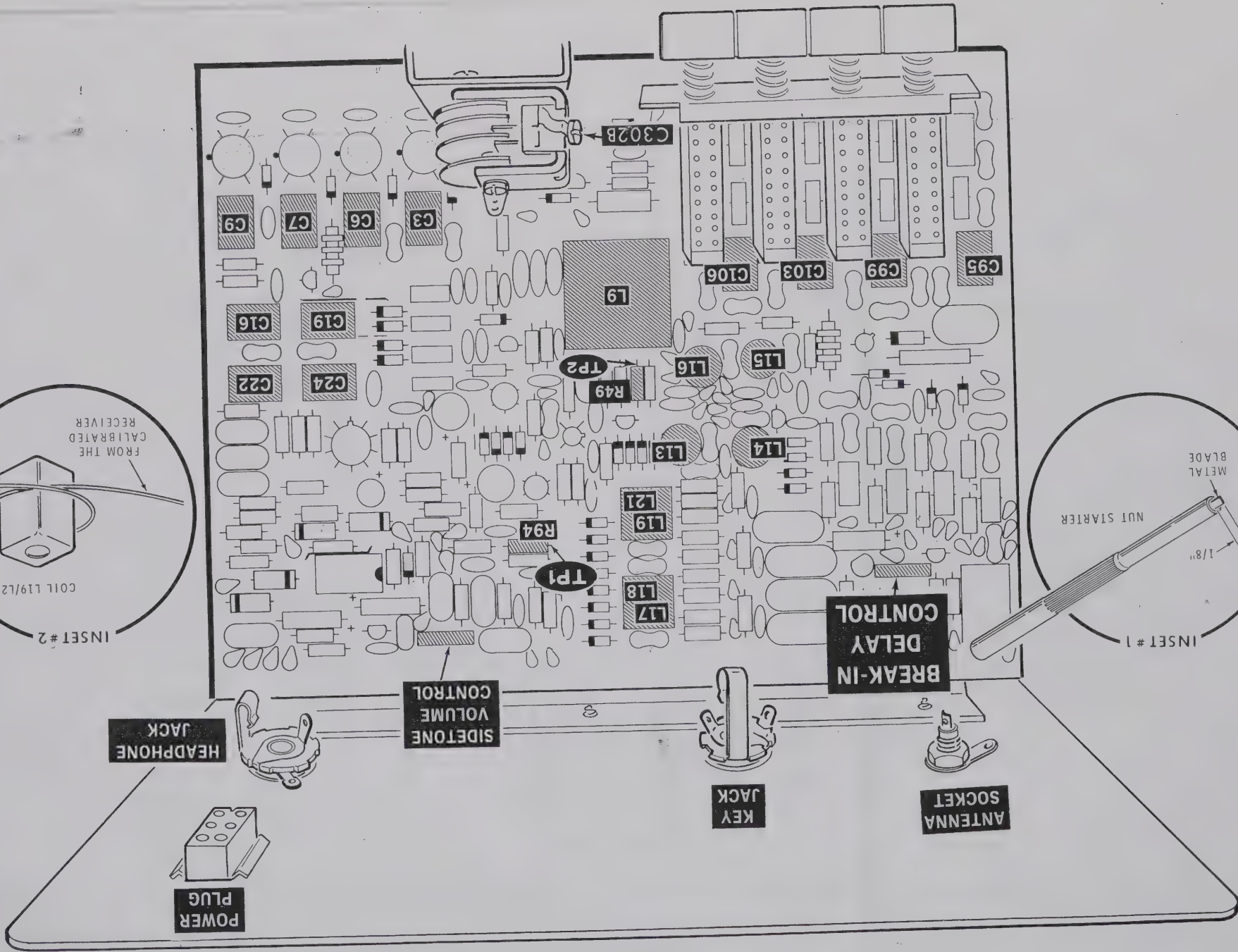
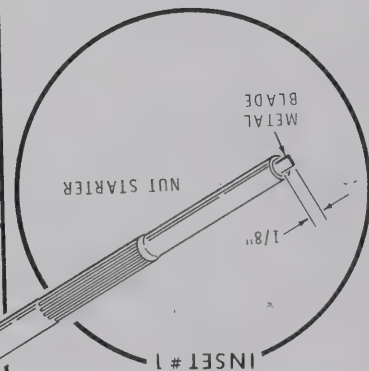
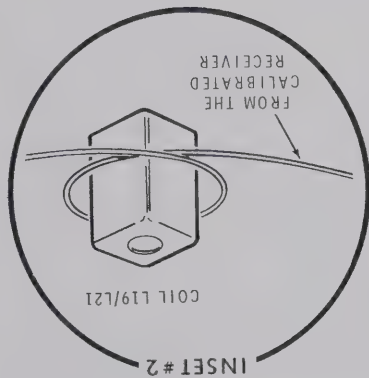
**BLOCK DIAGRAM**



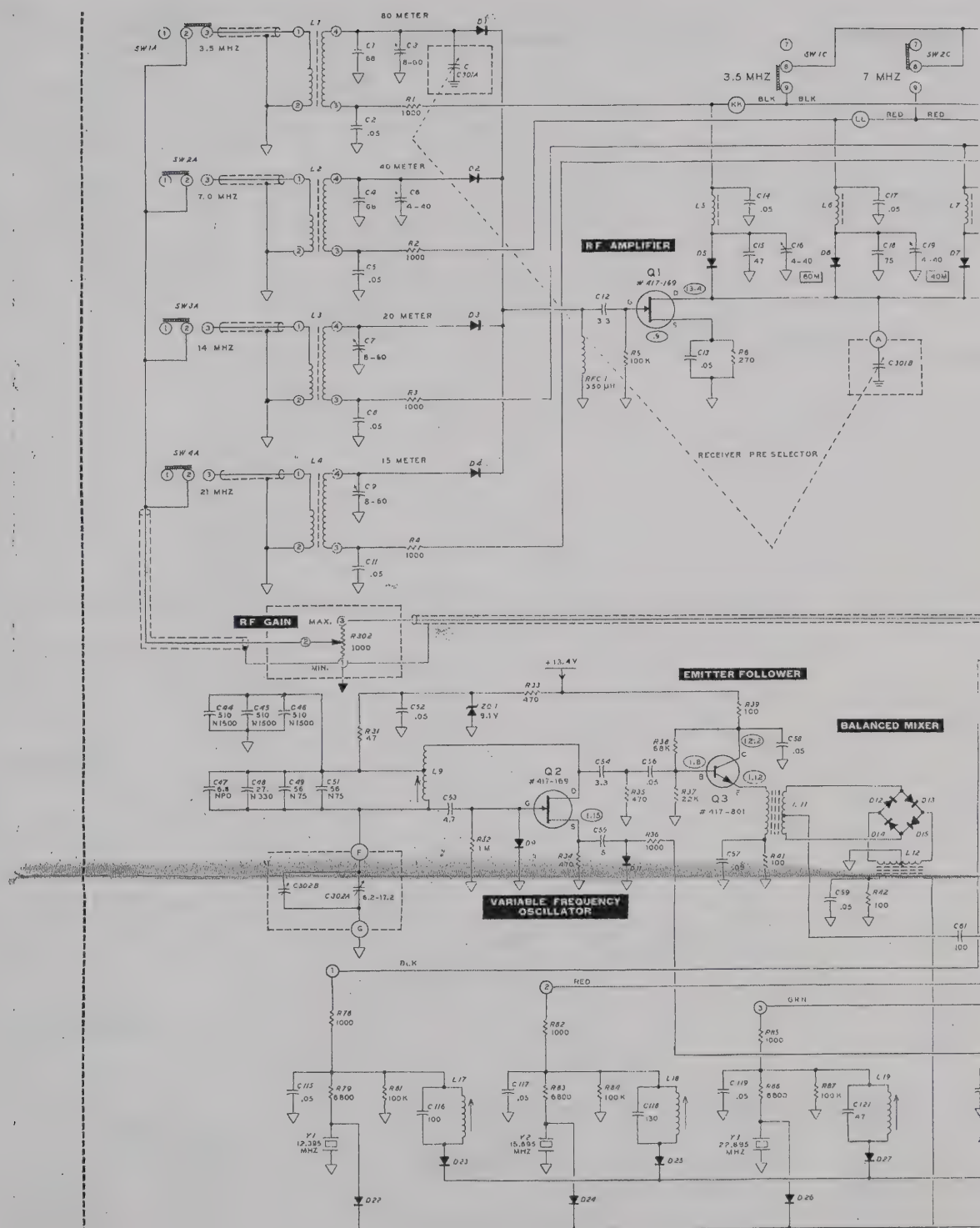


**Figure 1-2**

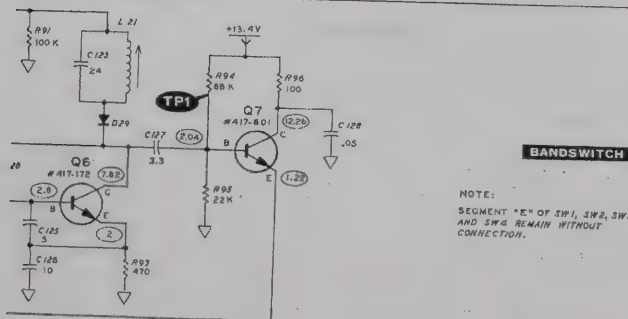
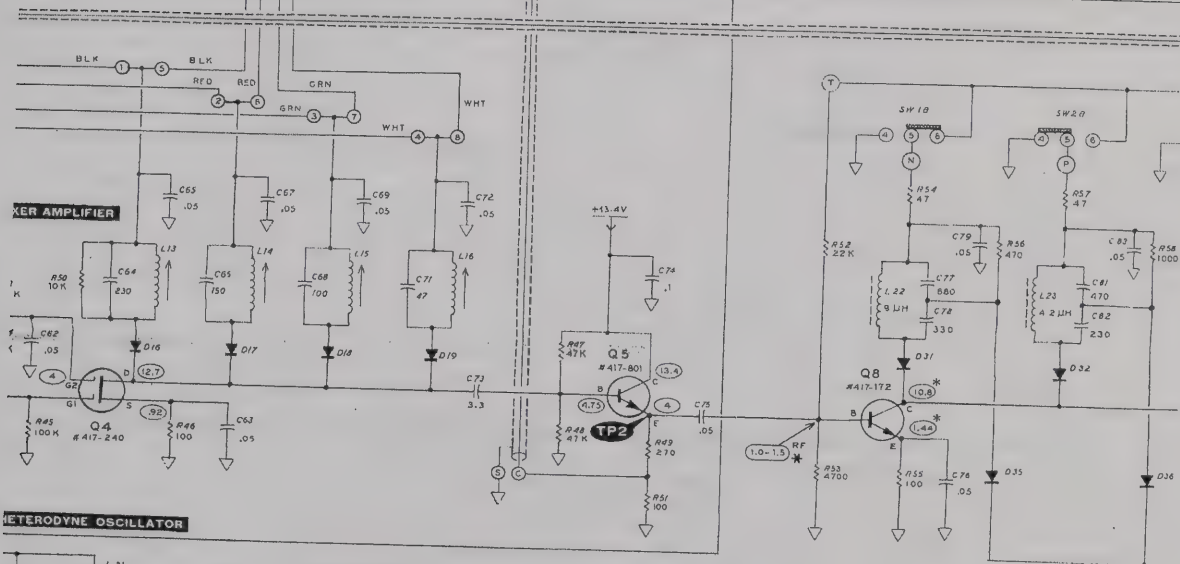
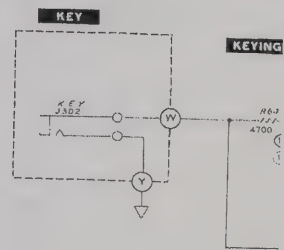
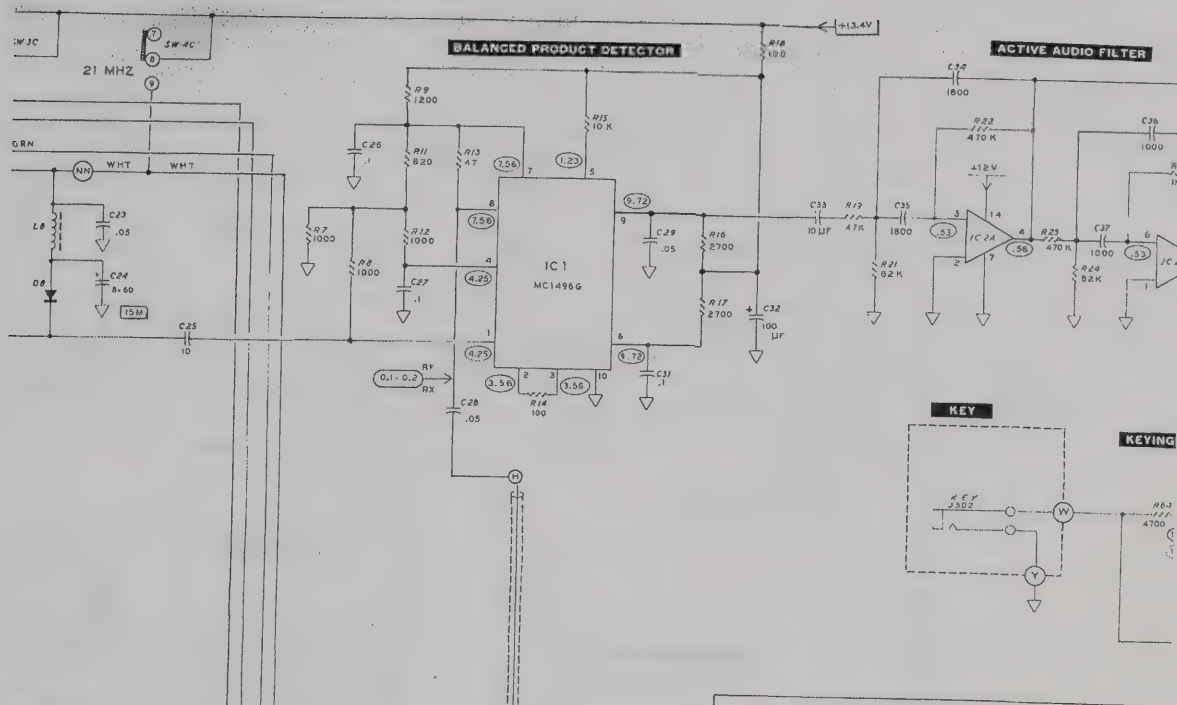




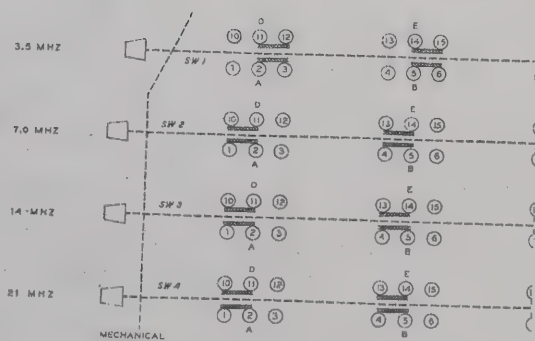




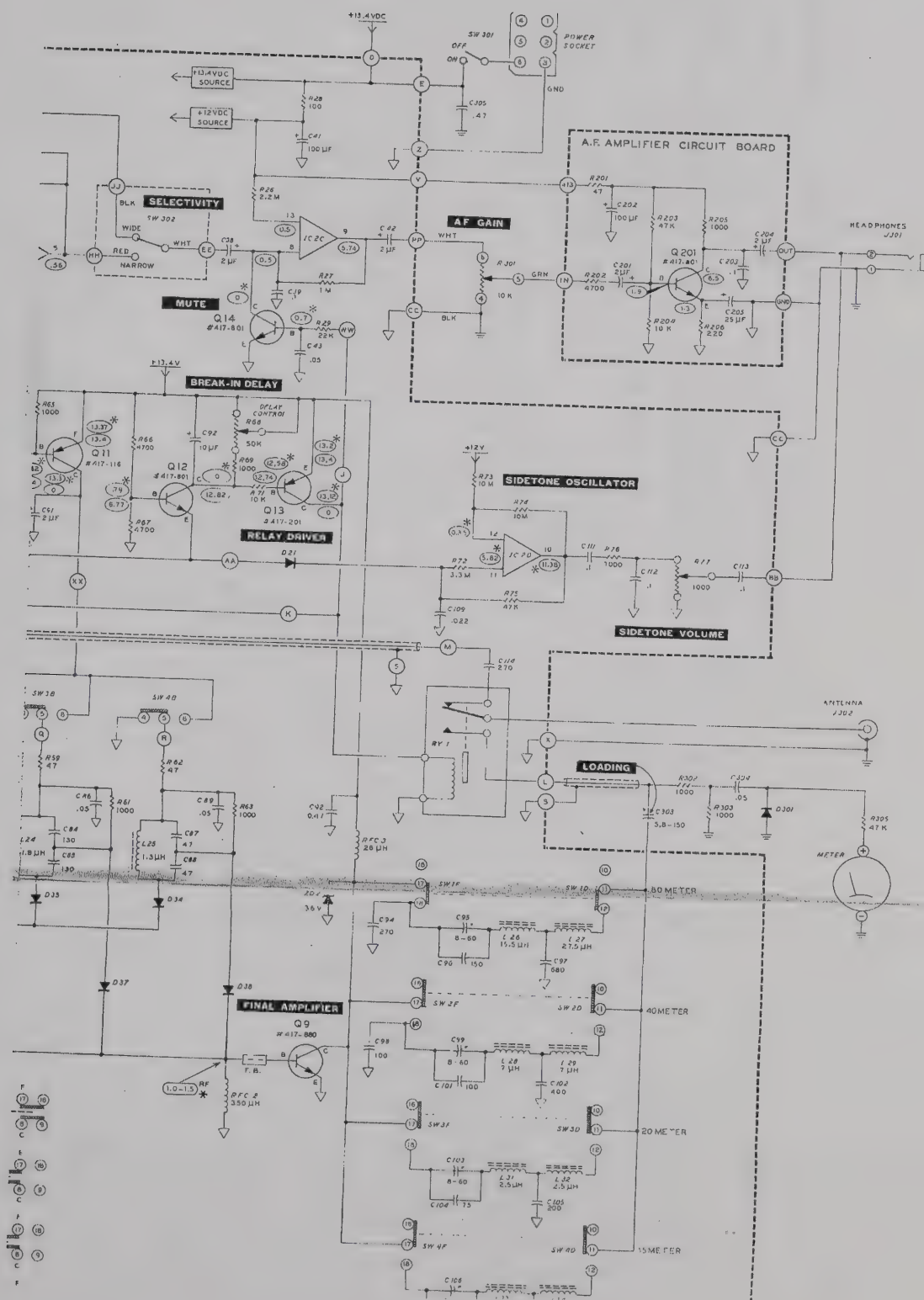




NOTE:  
SEGMENT "E" OF SW1, SW2, SW3,  
AND SW4 REMAIN WITHOUT  
CONNECTION.



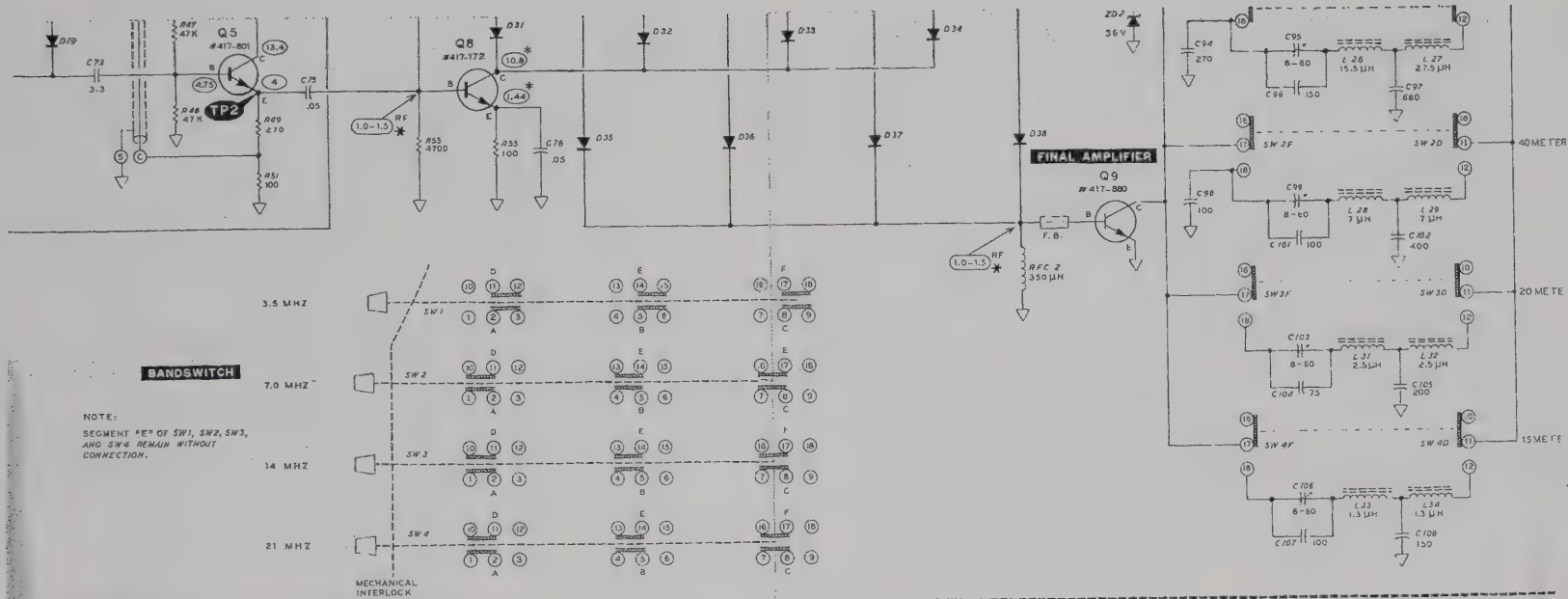
















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## Resurrecting a QRP Classic—Part 2

Without a doubt, finding a classic QRP rig like a Ten-Tec PM Series or Heathkit HW-7 or 8 at a flea market can be a thrill. However, many of these classic QRP rigs have been “modified” (and I use that word *very* loosely) by previous owners and, more often than not, they don’t work and are relegated to the dumpster after being lugged around from hamfest to hamfest without being sold.

Last month I briefly described the two modifications I performed on my newly acquired HW-8. This month, I have decided to detail these mods and provide some additional information regarding replacement parts for these older rigs.

### Oops!

As part of the HW-8 restoration I decided to perform a by-the-book alignment of the transceiver to ensure that all systems were working optimally. Everything was going well *until* I hooked up the dc power cables to the radio. You guessed it; I swapped the positive and negative leads totally by accident and my cherry little HW-8 became a nonworking \$125 paperweight!

I was in total shock! Recovering from my initial disbelief, I started to look over the HW-8 schematic to try to pinpoint the active devices that would need replacement. First there was IC1, the product detector, an MC-1496G. Then there was Q9, the PA transistor and ZD2, the over-voltage SWR protection diode connected from the PA collector to ground. The more I wandered around the schematic, the more things I found that connected directly to the  $V_{cc}$  supply line I had reverse polarized. Man, this was definitely not a good day!

Researching the MC-1496G I found that this device was no longer being produced. My local electronics parts supplier had a direct replacement—some NOS (new old stock) RCA SK3233 devices (\$4 each)—so I bought two. I also found the higher power replacement for the stock 2N4427 final amp, an NTE-488 PA transistor (\$13) along with the ECG-222 dual gate MOSFET used in the HW-8 as a mixer amplifier (Q4, Heath part no. 417-240). Dual gate MOSFETs are getting harder to find, so I picked up two at \$11 each. I unearthed several other replacement transistors: an NTE 133 (used for

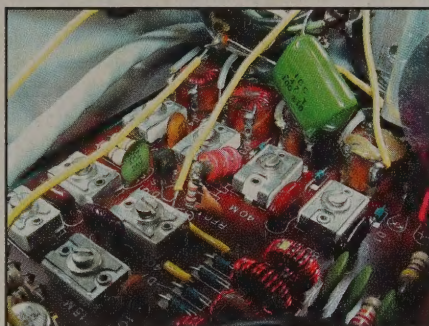


Figure 1—Two parts and five minutes = a cure for transmitter motorboating.

the RF amp, Q1, and the VFO, Q2, Heath part no. 417-169 at \$1 each) and a NTE 159 (keying transistor Q11, Heath part no. 41-116, and the relay driver, Q13, Heath part no. 417-201, also about \$1 each). The rest of the active devices in this rig are run-of-the-mill small signal NPN transistors that will directly sub with an NTE-123AP, 2N2222 or 2N3904 transistor.

### The “Call for Help”!

In desperation, I called Mike Bryce, WB8VGE ([prosolaratssnet.com](http://prosolaratssnet.com)), who publishes the *HW-8 Handbook*, the source book for everything you ever wanted to know about any of the Heath QRP rigs) and explained the situation to him. He stopped laughing after a few minutes and asked me what I had done, so far, in the way of troubleshooting. I listed the symptoms: no receiver noise, no transmitter output, no smoke and the power supply was going into overload protection once the rig was turned on. I had gone so far as to remove the  $V_{cc}$  from point “D” on the PC board to no avail.

Mike suggested the first place to look was overvoltage/SWR protection zener diode, ZD2 and the final amplifier, Q9, since both devices were directly connected to the  $V_{cc}$  line and were the most likely candidates to short and load down the supply. He also encouraged me saying that if I was *really* lucky, the zener diode had shorted first, taking out the PA transistor, and the rest of the rig should be fine. One could only hope.

Sure enough, I checked ZD2 and it was shorted. Ditto for the PA transistor. I powered up the HW-8 without these two de-

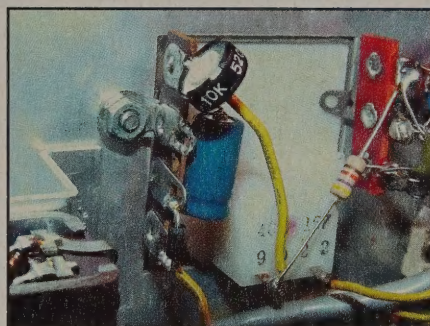


Figure 2—The audio-derived S-meter modification.

vices and was rewarded with a working receiver! Now I wasn’t feeling so bad. I replaced the zener diode and the PA transistor and found the transmitter had RF output. Things were beginning to look up.

After proceeding with a full alignment the HW-8s were perking along like new. The receiver was hot and RF output with the new PA was 2.75 W on 80, over 4 W on 40 and 20 and 2.5 W on 15 meters.

And yes, I soldered a 1N4001 silicon diode in reverse bias across the power leads coming in to the power connector for polarization protection. Of course I did this *after* I had reversed the power leads.

The moral of the story: do the reverse polarization modification *first* on these older rigs that don’t offer this feature. It certainly saves a lot of anguish, hair pulling and unnecessary troubleshooting.

Now for the two mods: Figure 1 shows a picture of the 390  $\Omega$  resistor in parallel with the 0.01  $\mu$ F disc ceramic capacitor soldered between the low end of RFC1 and ground. This mod is fully reversible and definitely tames the transmitter motorboating with only two parts and five minutes’ work.

Figure 2 shows the audio derived S-meter circuitry bolted to the left side of the meter and connected between the high side of the AF gain control and the positive side of the relative signal meter. The 10k potentiometer allows adjustment to where really loud signals are set for maximum deviation on the S meter. The electrolytic cap, a 47  $\mu$ F at 50 V, is used to select a relatively slow decay on the meter. You can choose a smaller value (like 16  $\mu$ F or 33  $\mu$ F) cap to provide faster decay time, resulting in a much more lively S meter.

QST

# Let's Put *Radio* Back in Ham Radio

By Sumner Weisman, W1WIV

With great interest, I read the article by Paul Cassel, VE3SY, "From Ether to Ethernet" [May 2003, pp 28-32]. His thorough description of IRLP, the Internet Radio Linking Project, intrigued me enough to go back and reread the previous article by Steve Ford, WB8IMY, "VoIP and Amateur Radio" [Feb 2003, pp 44-47], which described IRLP and several other systems.

All of these configurations have one thing in common: communication via the Internet, with a VHF or UHF FM transceiver providing a radio connection at each end. The more I thought about it, the more I marveled, "These are all clever schemes, but they are *not* ham radio!" In his article, VE3SY talks about the many technological changes in the last 85 years; from spark to CW to AM to SSB to VHF FM to the Internet linking of VHF/UHF Amateur Radio repeaters, as if they are all equal. In my opinion, he is ignoring the one basic difference. Up to the present time, all our communication methods were *over the air*. Now, hams are having QSOs on the Internet. The Internet is simply a worldwide system of interconnected *wired* computer networks. These hams, in other words, are talking over wires and calling it ham radio!

"Yes," they would reply, "but there is a VHF or UHF transceiver and repeater at each end. That makes it ham radio." Let me present some reasons why it isn't. Let's say that I, near Boston, have an IRLP QSO with a ham in Australia, a distance of about 10,000 miles. At each end, there is a 5 mile distance between the operator's radio and a repeater tower. This QSO, which consists of 10 miles of radio and 10,000 miles of wired networks, has a ham radio content of 0.1%. In other words, 99.9% of this contact is simply talking on the telephone. That's not ham radio by any present definition.

We make thousands of telephone calls using similar configurations every day. And, we correctly call them phone calls, not radio. For example, if I were to telephone a relative in California, cell phone to cell phone, is that radio? After all, the signals travel by RF to the local cell towers before being connected to wired

telephone networks. For another example, if I were to telephone the same person and we each use a cordless phone, is that radio? Again, the signals travel by RF some short distance from handset to base unit before the wired network connection. What's the difference between these systems and IRLP? There is no difference at all except for the use of other frequencies; they are all simply telephone calls.

So, the question is, where do you draw the line? Should a contact with only 5% of the distance via RF be called ham radio? 25%? 50%? I propose that a ham radio QSO be defined as one where at least half the distance is covered by an RF signal. I'm sure that some purists would insist that the entire contact must consist of a radio signal only, but I believe that there is certainly a place for the Internet in our hobby.

It's interesting to note that the *opposite* of these radio-connected telephone contacts were popular years ago, when hams were running overseas or cross-country phone patches. A telephone call was made at each end, through the phone patch at each ham's station, which allowed two non-hams to have a long-distance conversation by radio. Of course, it had to be controlled by the licensed ham operators. These contacts certainly met my 50% criterion, since the caller was generally within 100 miles or less of the ham's location, and the radio connection was often thousands of miles. Today, we've gone to the other extreme and substituted the Internet for what used to be the long-distance "over-the-air" portion.

There is another reason why I find the use of IRLP disturbing. Suddenly, a newly licensed Technician-class ham with a shiny new 5 W handheld transceiver can work DX all over the world. Where is the incentive to improve? To gain further knowledge? To learn about the challenges of antennas and transmission lines and matching networks and transceivers and linear amplifiers? Why bother upgrading to a General or Extra class license? There is no longer a reason for further study in the interest of self-improvement. IRLP may be an easy and quick way to attract more people to ham radio, but the over-used term "dumbing down" certainly

seems to apply to these new variations of our hobby.

One of the reasons governments around the world have given hams the valuable frequencies we now enjoy is so that a large pool of citizens would have skills in the technical aspects of radio communication in case of emergencies, war or other times of need. If our new hams only have the skills to talk into their handhelds as far as their local repeaters, then we no longer meet that need and our ham bands could be gradually given away to other more valuable services. The pressure to share our frequencies with others is already increasing every year.

I can hardly wait to see what comes next. Internet QSL cards? IRLP DXCC? We proudly call ourselves ham radio operators, but lately we've been going astray. Let's put the "radio" back into ham radio.

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5) The subject matter chosen must be of general interest to radio amateurs, and must be discussed in a way that will be understandable to a significant portion of the membership.

6) With the exception that the article need not be consistent with League policy, the article will be subject to the usual editorial review prior to acceptance.

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